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GEOGRAPHY.

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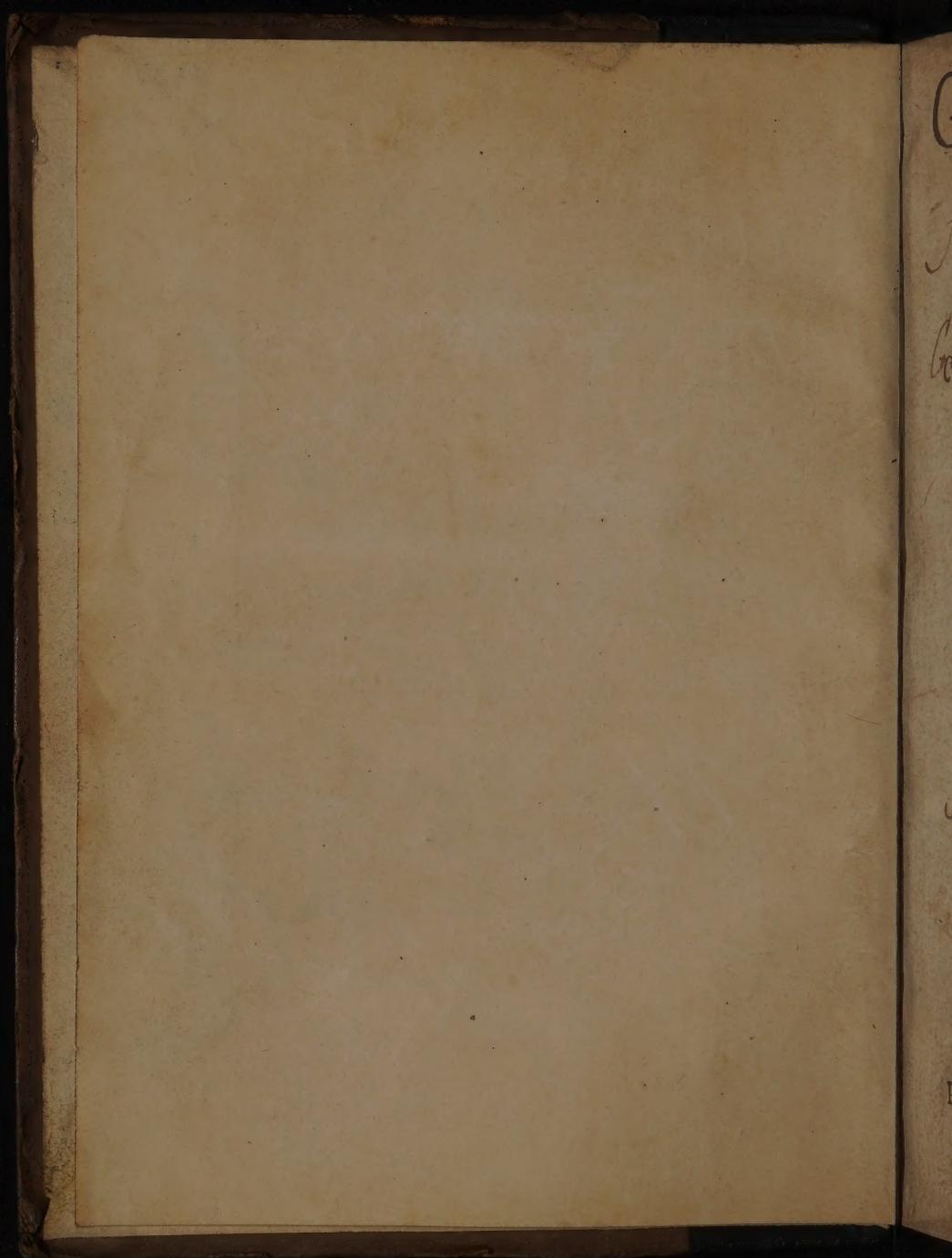
G. R. Carline, F.R.G.S.

April 1926

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GEOGRAPHY DELINEATED. AC FORTH IN TWO

BOOKES.

Sampson Eytyn Reynold Tetlars
CONTAINING THE SPHÆRICALL
AND TOPICALL PARTS
Sampson Eytyn THEREOF.

By NATHANIEL CARPENTER

Fellow of Exeter Colledge

in Oxford.

ECCLESIAST. I.

One generation commeth, and another goeth, but the
Earth remaineth for euer.



OXFORD,

Printed by JOHN LICHFIELD and WILLIAM
TURNER, Printers to the famous University,
for HENRY CRIPPS. An. Dom. 1625.

John Foster
his Book
1774

The Gift of the
Rev. Mr. Bisham



1774
John Foster
his Book
1774



TO THE RIGHT
HONOURABLE
WILLIAM,
EARLE OF PEMBROKE,
LORD CHAMBERLAINE
to the Kings most excellent Maiesty,
Knight of the most Noble
Order of the Garter, and
Chauncellour of the Vni-
versity of Oxford.

Right Honourable,

His poore Infant of mine,
which I now offer to Your
Honourable acceptance, was
consecrated Yours in the
first conception: If the ha-
sty desire I had to present it,

93 makes

THE EPISTLE

makes it (as an abortiue brat) seeme vnworthy my first wishes, and Your fauourable Patronage; impute it (I beseech You) not to Selfe mill, but Duty; which would rather shew herself too officious, then negligent. What I now dedicate, rather to Your Honour, then mine owne *Ambition*, I desire no farther to be accompted *Mine*, then Your generous approbation: wishing it no other fate, then either to *dye* with Your Dislike, or *live* with Your Name and Memory. The generall Acclamation of the Learned of this Age, acknowledging with all thankfull Duty, aswell Your Loue to *Learning*, as Zeale to *Religion*, hath long since stamp't me *Yours*. This arrogant Desire of mine, grounded more on Your Heroick vertues, then my priuat ends, promised me more in Your Honourable Estimation, then some others in Your Greatnesse. The expression of my selfe in these faculties beside my profession, indebted more to Loue, then Ability, sett's my Ambition a pitch higher then my Nature. But such is the Magnificent splendour of Your Countenance, which may easily lend Your poore Servant somuch light

as

DEDICATORY.

as to lead him out of Darknesse ; and, as the Sunne reflecting on the baser Earth , at once both view and guild his Imperfections. My language and formality I owe not to the Court, but *University* ; whereof I cannot but expect *Your Honour* to be an impartiall Vmpier, being a most vigorous Member of the one, and the Head of the other Corporation. If these fruites of my Labours purchase so much as *Your Honours* least Approbation, I shall hold my wishes euen accomplished in their ends, and desire onely to be thought so worthy in *Your Honourable esteeme*, as to
liue and dye

Your Honours poore Seruant

to command

NATHANIEL CARPENTER.

ANNUAL LITERATURE

OF THE SPECIALL CON-
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BOOKE ACCORDING
TO THE SEVERALL
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Edward Foster his
Book 1776

God give him grace all the
day of ^{his} life and all the
family of John Foster
and Ellen Foster
god bles us all

1776 & B

W. Foster

Edward



GEOGRAPHIE:

THE FIRST BOOKE.

CHAP. I.

*Of the Terrestriall Globe, the
matter and forme.*



GEOGRAPHIE is a science which teacheth the description of the whole Earth.

The Nature of *Geographie* is well expressed in the name: For *Geographie* resolued according to the *Greeke Etymologie*, signifieth as much as a description of the Earth; so that it differs from *Cosmographie*, as a part from the whole. Forasmuch as *Cosmographie* according to the name, is a description of the whole world, comprehending vnder it as well *Geographie*, as *Astronomie*. Howbeit, I confess, that amongst the ancient Writers, *Cosmographie* hath bin taken for one and the selfe-same science with *Geographie*; as may appeare by sundry treatises merely *Geographical*, yet intituled by the name of *Cosmographie*. This Science (according to our appro-
ved *Ptolemy*) is distinguished from *Chorographic* fowre wayes.

A

First

2. **GEOGRAPHIE. The first Booke.**

First, because *Geography* describeth the whole Spheare of the Earth, according to its iust quantity, proportion, figure, and dispositions, which the principall parts of it haue; as well in respect of one another, as of the whole Terrestrial Glebe: so that it onely vndertakes the chief and most noted parts, such as are sines, creekes, nations, cities, promontories, riuers, and famous mountaines. But the *Chorographer* separatly handleth the lesser parts, and matters of smaller moment, such as are hillocks, brookes, lakes, townes, villages, and Parishes, without any respect at all to the places adioyning, as conserning them with the *Sphericall* fabrick of the whole Earth: Which by the same Author is well illustrated by an example, drawne from the Painters Art: For we see that a Painter, desirous to draw out and represent the head of any liuing creature, will first draw out the lineaments of the first and greatest parts; as the eyes, eares, nose, mouth, forehead, and such like; only caring that they may challenge a due & iust proportion and symmetrie one with the other, not regarding the lesser particles and ornaments in each of these, wanting perhaps space competent to accomplish it. But if the same Painter would striue to expresse only an eye, or an eare, he might take space enough to designe out every smaller lineament, colour, shadow, or marke, as if it were naturall: for in this he cares not to make it correspondent to the whole head, & other parts of the body: So happens it to the *Geographer*, who willing to delineate out any part of the Earth, (as for example, our Realme of *England*) he would describe it as an Iland, encompassed round with the sea, & figured in a triangular forme, only expressing the principall and greater parts of it. But the *Chorographer* vndertaking the description of some speciaall and smaller part of *England*; as for example, the City of *Oxford*, descends much more particularly to matters of small quantity and note: such as are the Churches, Colledges, Halls, Streets, Springs; giuing to each of them their due accidents, colours, lineaments, and proportion, as farre forth as Art can imitate Nature. Neither in this kind of description needs there any consideration of the places adioyning, or the general draught of the whole Iland. The second difference between *Geographic* and

Cho-

Chorographie assigned by *Ptolomie*, consists in this; that *Chorographie* is commonly conversant in the accidentall qualities of each place, particularly noting vnto vs, which places are barren, fruitfull, sandy, stony, moist, dry, hot, cold, plain, or mountainous, and such like proprieties. But *Geography* lesse regarding their qualities, inquires rather of the *Quantities, measures, distances*, which places haue aswell in regard one of the other, as of the whole *Globe of the Earth*: assigning to each region its true longitude, latitude, clime, parallell, and Meridian. ³ *Geographicie* and *Chorography* are said to differ, because *Geographicie* stands in little need of the Art of Painting, for as much as it is conversant the most part about the Geometrical lineaments of the Terrestriall *Globe*, clayming great affinity with the Art called of the *Greekes, Ichnographie*; whose office is to expresse the figure & proportion of bodies, set forth in a plain *superficies*. But contrarywise *Chorography* requires, as a help necessary, the Art of Painting; forasmuch as no man can fully and perfectly expresse to the eye the true portraict of cities, towns, castels, promontories, & such other things, in their true colours, liuely-hood, & proportion; except they be skilled in the Art of Painting. So that this part is by some likened to that Art which the *Greekes* call *Sciographie, or Scenographie*. Fourthly, & lastly, *Geographicie* is distinguished from *Chorography*, in that the former considering chiefly the quantity, measure, figure, site, & proportion of places, as well in respect one of the other, as of the *Heauens*, requires necessary helps of the Sciences Mathematicall, chiefly of *Arithmetick, Geometry, & Astronomie*, without which a *Geographer* would shew himselfe every-where lame & impotent, being not able to wade thorough the least part of his profession: whereas a man altogether vnpractised in those faculties, might obtaine a competent knowledge in *Chorography*. As we find by experiance, some altogether ignorant in the Mathematicks; who can, to some content of their hearers, *Topographically*, and *Historically* discourse of Countries, as they haue read of in books, or obserued in their trauaile. Notwithstanding all these differences assigned by *Ptolomie*, I see no great reason why *Chorography* should not be referred to *Geographicie*; as a

part to the whole; forasmuch as the obiects on which he hath grounded his distinction, differ only as a generall and a speciall; which being not opposite, but subordinate (as the *Logicians* vse to speak) cannot make two distinct Sciences, but are reduced to one & the selfe-same: at least the differences thus assign'd, will not be *Essentiall*, but *Accidental*. Wherefore my scope in this Treatise shall be to ioyne them both together in the same, so far forth as my Art and leisure shalbe able, to descend to particulars; which being in *Chorographicie* almost infinite, will not all seeme alike necessary in the description of the vniversall Globe of the Earth. The name of *Geographicie* thus distinguisched, we define it to be a *Science* which teacheth the *Measure* and *Description* of the whole *Earth*. It is properly termed a *Science*, because it proposeth to it selfe no other end but knowledge; whereas those faculties are commonly termed *Arts*, which are not contented with a bare knowledge or speculation, but are directed to some farther work or action. But here a doubt seemes to arise, whether this *Science* be to be esteemed *Physicall*, or *Mathematicall*? We answere, that in a *Science* two things are to be considered: first, the *matter* or obiect whereabout it is conversant; seconly, the *manner* of handling and explication: For the former, no doubt can be made, but that the obiect in *Geographicie* is for the most part *Physicall*, consisting of the parts whereof the Spheare is composed: but for the manner of Explication, it is not *pure*, but *mixt*; as in the former part *Mathematicall*, in the second rather *Historicall*; whence the whole *Science* may be alike termed *Mathematicall* and *Historicall*; not in respect of the *Subiect* which we haue said to be *Physicall*, but in the *manner* of *Explication*. For the obiect of *Geographicie* (as we haue intimated) is the whole *Globe* of the *Earth*: where we are to obserue, that the *Earth* may be considered 2 manner of wayes: First, as it is an *Element*, out of which mixt Bodies are in part compounded: In which sense it appertaines to *Naturall Philosophie*, whose office is to treat of all *naturall bodies*, their *principles* and *proprieties*. Secondly, as it is supposed to be the *center* of *heauenly motions*, and so it is undertaken by *Astronomers*. Thirdly according to its *Sphericall*

super-

superficies, as it is proposed to be measured or described, in which manner it is the subiect of *Geographie*, so far forth as the parts of it haue a diuerte situation, as well in regard one of another, as in respect of the Heauens. Which restriction, although agreeing well to some part of it, will hardly square with all the rest: because many things herein are handled besides the Earths naturall site or position, as hereafter shall be taught. For which cause we haue rather defined the subiect of *Geographie* to be the *Earth*, so far as it is to be measured and described, as wanting one word to expresse the whole manner of consideration.

2 Geographic consists of 2 parts, the Sphæricall, and Topicall: The Sphæricall part is that which teacheth the naturall constitution of the Terrestriall Spheare.

The common and receiued diuision of this *Science* amongst *Geographers*, is into the *General* or *vniversall* part; and the *Speciall*. Which diuision, I dare not vtterly reject, being strengthened with the authority of ancient & approued Authors. Yet seems it more aptly to be applyed to the *Historicall* part, then to the whole *Science*, as we shall after make apparent. In the meane time the diuision of it into Sphæricall & Topicall parts, seemes to be preferred in reason: Forasmuch as the *Terrestriall Globe*, which we suppose to be the subiect of the *Science*, is proposed to vs vnder a twofold consideration; first in regard of the *Mathematicall* lineaments and circles, whereof the Spheare is imagined to consist; out of which we collect the figure, quantity, site, and due proportion of the Earth, and its parts: Secondly, of the places *Historically* noted and designed out vnto vs, by certain names, marks, and characters. The former receiueth greatest light from *Astronomic*, whence some haue called it the *Astronomical* part: The latet from *Philosophie* and *Historicall* obseruation, being (as we haue said) a mixt *Science*, taking part of diuers faculties.

A s 3. The



3 The Terrestriall Spheare is a globous or round Body, comprehended within the *superficies* of the Earth and Water.

Some haue nicely distinguished betwixt a *Spheare* and an *Orbe*; that a *Spheare* is a round massie body, contained in one surface, which is convexe or outward as a Bowle. The other concave, or hollow, in manner of an Egg-shell emptyed. But this distinction seemes too curious, as fauouring too much of Scholaisticall subtilitie, because the name of *Orbe* and *Spheare* are many times promiscuously vsed, without difference, amōgst good Writers. This *Spheare* which we make the subject of our Science, we call *Terrestriall*, not because it consists merely of Earth; (the contrary of which we shall hereafter shew;) but because the Earth is the chiefeſt in the composition; whence by a tropicall kind of speach, the whole *Globe* may be called *Terrestrial*.

4 The handling of the Terrestriall Spheare is either *Primary*, or *Secundary*. The Primary consists in ſuch affections as primarily agree to the Earth.

The *Geographicall Affections* may be conſidered two wayes, either ſimply and abſolutely in themſelues; or *comparatiuely* as they are conſidered & compared the one with the other. As for example, the circles of the *Spheare*, ſuch as are the *Parallels* and *Meridians*, may be conſidered either abſolutely in themſelues; or comparatiuely as they concurre to the *longitude*, *latitude*, *diſtance*, or ſuch like accidents, which arife out of the comparison of one Circle with another.

5 The Terrestriall Spheare primarily conſidered, is either *Naturall*, or *Artificiall*. The *Naturall* is the true *Globe* in it ſelue, without image or representation.

6 Herein

6 Herein againe are to bee considered two things ; First, the *Principles* and constitution of the Spheare; Secondly, the *Accidents* and proprieties : The principles whereof the Spheare is composed are two; viz: *Matter* and *Forme*.

7 The Matter is the substance whereof the Spheare is made, viz: *Earth*, and *Water*.

My meaning is not in this Treatise to handle the nature and proprieties of these two Elements, *Water*, & *Earth*, farther then may seeme necessary for the Geographicall constitution of the *Terrestriall Spheare*, leauing the rest to the Naturall Philosopher ; because it is supposed that few men vndertake the study of this Science, without some insight in the other. And to speak truth, this begins where the Naturall Philosopher ends. Yet because some light in each learning is necessarily required, and all men are not willing to seek farther into the grounds of *Naturall Philosophie*; it will not seeme altogether impertinent, to lay the foundation farther off, that the building thereon erected may stand surer and stronger. Wherefore taking some beginning from the matter of the Earthly Globe, we haue distinguiſhed it into *Earth*, and *Water*, as those parts whereof the whole Globe is not essentially compounded, as one intire body in itſelfe ; but rather coaccrvated and compacted together, each part retaining its own nature and proprieties, without any proper mixture. To expresse more fully the constitution of this Spheare, we are here to distinguish betwixt the *first* and *second* matter. The first matter was that vniuersall *chaos*, or *masse*, out of which, all bodies both *Celestiall* and *Elementarie* were made, & formed, as we read in the first of *Genesis*. Which whether it be the same with *Aristotle's Materia prima*, as some haue imagined, I leau to others to dispute. The *second* matter of the Globe is either *Proper* or *Accidentall*. The proper we call that whereof

8. **GEOGRAPHIE.** *The first Booke.*

whereof the Globe of the Earth most properly consists, such as are the two Elements of *Earth & Water*. The Accidental matter is vnderstood of all other bodies, contained in the *superficies* of the said Spheare, as *Stones, Metals, Minerals*, and such like materials, made of a Terrestriall substance, & engendred in the wombe of the Earth. Concerning the *Earth and Water*, which we make the most proper and essentiall parts of the Spheare, we will set down these two Theoremes.

I. In the Terrestriall Spheare is more Earth then VVater.

The Theoreme may be proued by sundry reasons drawne from *Nature and Experience*. Whereof the first may be taken from the depth of the waters, compared with the whole thicknes of the Earth. For the ordinary depth of the Sea is seldome found to be aboue 2 or 3 miles, and in few places 10 furlongs, which make a mile and a quarter. And albeit some late Writers haue imagined the observation to be vnderstood only of *straight and narrow Seas*, and not of the main Ocean: yet granting it to amount to 10, 20, or 30 miles, it cannot reach to so great a quantity, as to come neare the greatnes of the Earth. For the whole circle of the Terrestriall Spheare being 21600 English miles, (allowing 60 English miles to a degree of a greater circle) we shall find the Diameter to be about 7200 miles: Whose semi-diameter, measuring the distance between the center & the *superficies* of the Earth, wil be 3600 miles. And if any man suppose some of the quātity to be abated, because of the Sphæricall swelling of the Water aboue the Earth, whose Circle must be greater then that of the Earth: We answer; first that this may challenge some abatemet, but not come neare any æquality of the *Water* with the *Earth*. Secondly it is to be imagined that the surface of the Sea, howsoeuer as it is painted in Globes and Charts, it seeme for a great part empty and vnfurnished of llands; yet this for the greatest part, seemes rather to be ascribed to mans ignorance, & want of true discouery, because many quillets and parcels of land lye yet vnown to our Christian World, and therefore omitted, and not figured in our

our ordinary Mappes. So we find a great quantity of Earth which lay hid and vnknown without discouery, in the dayes of *Ptolomy*, which caused him to contract and curtaile the Earth in his *Geographicall* descriptions. Which defect hath bin since that time supplied by the industrious trauailes and Navigations of later time; such as were of *Portugals*, *English*, and *Hollanders*; especially of *Columbus* the *Italian*, who (as one wittily alluding to his name) like *Noah's* Dowe plucking an olive branch from this Land, gaue testimony of a portion of Land as yet vnknown, and left naked vnto discouery. And no question can be made, but a great quantity of land, not yet detected by our *European* Navigators, awaites the industry of this age. To whiche alludes the Poët in these Verses:

Seneca in
Medea. Act. 2.

*Venient annis secula seris,
Quibus Oceanus vincula rerum
Laxet, & ingens pateat tellus,
Tiphisq; novos detegat orbes,
Nec sit terris ultima Thule.*

In after yeares shall Ages come,
When th' Ocean shall vnloose the bands
Of things, and shew vast ample lands;
New Worlds by Sea-men shall be found,
Nor Thule be the vtmost bound.

Another reason to proue the Earth to be greater in quantity, may be drawn from the mixture of *Earth* and *Water*: for if these two Elements should meet in the same quantity, & challenge an equality; questionlesse the whole Earth would proue ouer moist, slymie, and vnapte for habitation. Which any man may easily obserue by his own experience. For let a portion of Earth, & another of Water be mixt together in the same quantity, the whole masse will seem no other then a heap of mire or slime, without any solid or consisting substance. Moreouer the Water being no other then a thin and fluid body, hardly containing it self within its own bounds or limits (as Aristotle tea- *De gen. & cœch.*

cheth vs) must needs require a hard and solid body, whereon to support it selfe, which body must of necessity be greater in quantity.

2 The Earth and Water together make one Spheare.

It may be probably collected from sundry places of holy Scripture, that in the first Creation, the surface of the Earth; being round and vnliforme, was ouer-whelmed and compass'd round with Waters, as yet vnfurnished of liuing Creatures. Secondly, it appeares that Almighty GOD afterwards made a separation betwixt the *Waters* and *Dry Land*. This separation (as farre as reason may be admitted as Judge) seemes to be effected one of these two wayes: Either by giuing super-natural bounds and limits vnto the Waters, not suffering them to invade the *Dry land*: or els by altering the *superficies* of the Earth, casting it into inequall parts, so that some-where, some parts of it being taken away, empty channels or concavities might be left to receiue the Waters; other-where by heaping vp the parts so taken away, whence were caused *Mountaines* and eminent places on the Earth. The former of these wayes seemes altogether improbable; forasmuch as it is very vnlikely to imagine, that God in the first institution of Nature, should impose a perpetuall violence vpon Nature, as hereafter in place more convenient shalbe demonstrated. Wherefore taking the later as more consonant to reason; we shall find that the Water & the Earth separated and diuided, make not two separate and distin Globes, but one and the same Spheare; forasmuch as the concavities and hollow gapings of the Earth, are euery-where choaked and filled vp with Water, whose *superficies* is Sphaericall; & therefore helps, together with the Earth, to accomplish and perfect this *Terrestriall Spheare*. To confirme which opinion, these reasons out of common experience may be alledged: The first is drawne from the parts of Earth and Water; For we may euery-where obserue, that a portion of Earth, and another of Water being let fall, will descend in the same right line toward the same center: whence we may evidently conclude, that the

Earth

Earth & Water haue one and the self-same center of their motion, and by a consequence conspire to the composition of one and the self-same Spheare. Secondly, to a like Arch or space in the Heauens, is found answerable alike Arch in the *Terrestriall Globe*, whether it be measured by the Earth or Water: which could not happen, were they not accounted parts of the same Spheare. The third reason may be drawn from the *Eclipse* of the Moon, wherein the part of the Moon shadowed & obscured, is obserued to be one Sphæricall or round figure. This shadow, by the consent of all *Astronomers*, is caused by the *Terrestriall Spheare*, interposed betwixt the Sun and the Moon, intercepting the Sun-beames, which should illuminate the Moon; & the shadowes imitate the opacous bodies, whence they arise: But in the *Eclipse* we find only the shadow of one body or Spheare, and therefore according to the ground of the *Opticks*, we may conclude the body wherof such a shadow procedeth, to be but one and the self-same Spheare.

8 The Forme of the Terrestriall Spheare, is the naturall Harmony or order, arising from the parts working together.

We ought here to remember what we said before; that the Earth and the Water concurre together to make one *Terrestriall Spheare*: wherefore the whole being accounted one coacer-vated and collected Body, made of two other; we are not to ex-pect an *Internall*, *Essentiall*, and *Specificall* Forme, such as *Aristotle* recounts amongst the principles of a Naturall Body: but only such a one as in it selfis *Externall* and *Accidental*, yet concurring (as it were) Essentially to the constitution of the *Terrestriall Spheare*, whose Fabrick and first composition, can not well be vnderstood without it. Some haue imagined the whole Globe of the Earth to be informed with one *Internall* and *Essentiall* Forme; which opinion seemes to haue much affinity with that of *Plato's*, concerning the *Soul* of the World: Not that *Plato* and his followers were so absurd to defend, that the World with all his parts was animated with a true vitall Soul, in the nature of a liuing Creature: but that all the members of

it were united together, quickned, and disposed by a certain *Energeticall* power or vertue, which had great resemblance and representation of the Soule of man. Which assertion seemes to be restored and embraced by our late *Magneticall Philosophers*, whose opinion we shall discusse and examine hereafter in place convenient. In the mean time, grounding our discourse on known principles ; we can admit no other *Forme* in the *Spheare* of the Earth, then the mutuall *Harmony*, order, & concent of the parts, concurring together, and working the perfection and perpetuation of the whole. A fit resemblance whereof we may obserue in an artificiall Clock, Mill, or such like great Engine, wherein every part duly performing its own office, there will arise and result a naturall *Harmony*, which not vnaptly may be termed the *Forme* of the whole Engine. Why the World should not consist of an *Internall* and *Essentiaill* *Forme*, sundry reasons haue bin alleadged by our common *Philosophers*: First, because Nature nevert attempteth any thing in vain, or without a determinate end; But the particular *Formes* of speciall Bodies (say these *Philosophers*) are sufficient for the vniuity and conformatiōn of this *Terrestriall Globe*: so that to grant an vniuersall *Forme* of the whole, were to multiply causes without any necessity, and make Nature the Mother of superfluit, which to all *Philosophers* seemes most absurd. Secondly, if this were admitted; the whole *Spheare* of the Earth would be as one continuat Body, whose parts should (as it were) suffer a fellow-feeling one of the other. Thirdly, it were a difficult matter to assigne, to what kind such a *Forme* might be reduced, whether *Animate*, or *Inanimate*. If *Inanimate*, whether it were *simple*, or *compound*. If *Animate*, whether *Vegetative*, *Sensitiae*, or *Rationall*; vnder the which are couched many great difficulties, as yet vndiscovered. Whether these reasons be of any great force to ouerthrow the aduersē opinion, I leaue it to further inquiry: intending here a *Geographicall*, not a *Physicall* Discourse.

CHAP.

C H A P. II.

Of the conformitie of parts in the constitution
of the Terrestriall Spheare.

- 1 **I**N the former wee haue treated of the Naturall constitution of the Terrestrial Spheare, aswell in *Matter* as *Forme*: It is needfull in the next place to treat of such *Affections* and proprieties as necessarily arise out of such a Constitution.
- 2 Those *Affections* or Proprieties are of two sorts, *Reall* or *Imaginarie*: Reall I call such as agree to the Terrestriall Globe by Nature: Imaginariy, such as agree to it by vertue of our vnderstanding.
- 3 Againe the Affections *Really* or Naturally agreeing to the Terrene Spheare, are assignd either in respect of the *Earth* it selfe, or in respect of the *Heauens*.
- 4 These Affections are said to agree to the *Earth* in respect of it selfe, which may bee expressed and vnderstood without any comparing of it with the celestiall Bodies:
These againe are twofold; either *Elementarie*, or *Magneticall*. Elementarie I terme

such as haue commonly beeene knowne or obserued by ordinary Philosophers. Here is chiefly to be considered the conformity of the Terrestriall parts, in the making and constitution of the whole Spheare.

In the former Chapter we haue shewed, that the Forme of the Terrestriall Spheare, is nothing els but the concinnity and apt conspiration of the parts whereof the whole is compouned. This conformity being diuers and manifold, as well in regard of the parts conforming themselues, as the manner of the conformity, we shall particularly and distinctly treat of, so far as appertaines to a *Cosmographer*. Here by the way I can not but taxe some defect in most of our common *Cosmographers*, who taking the *Sphericall* roundnes of the Earth for a granted supposition, are nothing curious to search into the first grounds and causes of this rotundity, whereby it first became a globous Body; and afterwards retaines in it selfe a Naturall vigour or power (if any violence should be offered) to restore her selfe to her former right and perfection. All which are very pleasant & profitable, to giue an industrious Learner some satisfaction. To explaine this before we descend to particulars, we will lay this ground and Theoreme;

I. *The parts of the Terrestriall Spheare, doe naturally conforme and dispose themselves, as well to the production and generation, as to the continuance and preseruation of it.*

The forme of the Terrestriall Spheare, albeit (as we haue shewed) it be *Externall* in respect of the whole *Globe*: yet may we call it *naturall*; forasmuch as it issueth and ariseth from the naturall disposition and inclination of all the parts. To understand which clause the better, we are to consider that a thing may be called *Naturall* two manner of wayes: first in regard of the *primary intent of Nature*; as the nearest and immediate

end

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end or scope to which she is directed. Secondly, in respect of her *secondary* intent or purpose, as that which must of necessity follow the former. True it is that every Terrene Body, according to Natures *first* intention, seeks and works it's owne perfection and conseruation. Neuerthelesse according to her *secondary* Intent, it concurses to the perfection and good of the whole vniuerse; which we shall plainly see in a stone or clodd of earth; which separated and remoued from it's mother, the Spheare of the Earth, by his descent and falling downewards, seeks first his owne conseruation, by reuniting it selfe to the Earth whence it was taken: Secondly, of the whole Globe of the Earth, which by this vniion and addition, no doubt, is made more compleat and perfect. This conformity of the Terrestriall parts, out of which ariseth the Earths *Sphericity*; I call the naturall inclination they haue to moue & settle themselues in such a site or position, as may bring forth a *Sphericall* consistency: so that if it were possible (as what cannot be to Gods Almighty power?) that the whole Globe of the earth were dissolued and rent into little peeces; yet were that vigor and motiue inclination remaining in the parts, whereby they might settle and conforme themselues to the same *sphericall* nature, and composition which it formerly enjoyed. For all the parts thus supposed to be distracted, would (no question) meet together & conform themselues to the same point or Center; and so equally poising themselues, would restore the same Spheare so dissolued: So that we here note a double inclination and motion of earthly bodies; first by a *Right line*, of the parts tending towards the Center; the other *Sphericall* of the whole *Spheare*, whereof the first in nature precedes the composition of the Spheare, the other followes. But this latter motion I leauue doubtful, till place convenient.

6. The conformity of the Terrene parts is twofold; *Primarie*, or *Secondarie*. The former is that whereby all earthly bodies are by a right line carried and directed to the Cen-

ter of the Terrestriall Globe.

As in an *Artificiall* Spheare or circle, drawne by a Geometrician, their principall parts are expressed, to wit, the Center, Ray, and circumference: so in the *Naturall* Globe of the Earth, these three, as it were Naturally & Really discouer themselves vnto vs. For first there is set a fixt point, to which all heauy bodies moue and conforme themselves. Secondly, there is set the line or *Radius*, in which such bodies are carried and conveyed. Thirdly, the confluence of all these parts, begets the *roundnesse* and *Sphæricall forme*. To beginne first with that which is first in nature, we will take these grounds.

I All Earthly Bodies incline and approach to the Center as neere as they can.

This proposition so farre forth as it concernes the two Elements of *Earth* and *Water*, is confirmed by commone experience, and therefore needs no long demonstration. For we see plainly, that not only these two doe incline (as much as may be, all obstacles being remoued) to the Center of the Earth; but also all mixt bodies compounded of them, being ouerswayed with the most predominant element, to challenge to themselves the same motion. I say not that all these Terrestriall bodies drive & meet in the Center (for that were impossible, that all this massy Spheare should be contracted to one point) but that all the parts haue a mutuall inclination to approach as neere the Center, as the necessity of the place, and the concurrence of them amogst themselves will suffer. By these Terrestriall Bodies which inioye this motion & inclination, we vnderstand first the two Elements of *Earth* and *Water*, with all other bodies arising out of their mixture. To these I may adde the *Ayre*, which by reason of his affinity with the *Earth* and *Water*, and naturall conformity to the same Center, we may well term an earthly body. It is commonly reported that the *Ayre* is *light*, and therefore carried vpwards, not inclining at all to the Center of the Terrestriall Globe; as the parts of these two Elements are. But this assertion, although bolstred vp, both with antiquity and authority; I take either to bee false, or misynderstood,

and

and that I speake no more herein then I can proue; I will produce some reasons (strong enough, as I thinke) to perswade that the Ayre is a heauy body, hauing a due inclination and confor-
mity to the Center of the Earth: First therefore will I produce this experiment. When a Well- or deepe Trench is digged vp in the earth, I would willingly demand whether the Aire descends to fill vp this Trench or concavity; or else a void space is left vnfurnished of any natural body to fill it? If they admit the lat-
ter, they wil consequently bring in againe that *vacuum*, or void space which *Arist.* and all sound Philosophers haue long since proscribed the confines of nature. If they affirme the former, that the Ayre descends to fill vp this empty space, I will aske againe, whether this descent of the Ayre be violent or naturall: If they say Naturall, they admit our assertion, that the Ayre na-
turally descends towards the Center, and so by consequence that it is heauy and not light by nature. Neither according to our *Peripateticall* Philosophy can wee ascribe more then one motion to the Aire, because it is a ground generally receaued among *Aristoteleans*: that One simple body can claime but one simple motion: much lesse one simple forme, as that of the Aire, can produce two opposite and contrary motions, such as are *Ascent* & *Descent* of the same body. If they chance to light on the other member of our distinction, and say that the motion of the Aire in this sort is violent, it must needs follow, that it must haue some externall cause or principle whence it should pro-
ceed; because all such motions proceed from externall causes. But here no such cause can be assigned: For the cause would be either the Earth which is so made hollow, or the emptinesse, or *vacuum*, or at least the other parts of the Aire. That it is not the Earth, may be proued; first because no Philosopher hath e-
ver shewed any such Attractiue power to reside in the Earth, but rather the contrary; because the Earth and Ayre by most haue beeene thought opposite in nature, and repugnant one to the other. Secondly, because Philosophy teacheth, that no agent can worke vpon a separate and distinct patient, except there be a meeting of the Agent and Patient in some meane. But here in this supposition, the Earth is imagined to drawe and attract

the Aire, which as yet it toucheth not. That this exterrall cause is not the *Vacuum* or Emptiness, is plaine; because it was never granted to haue any being or exisstance, much lesse any causality in nature. Some perhaps will say, that not the *Vacuum* it selfe, but the exitation and auoiding it, is the cause of the motion. I deny not but this may in some sort bee interpreted a cause, but the doubt is not answered: For we seeke not a *Finall* but an *Efficient* cause; and a curious searcher into Nature, will hardly rest in a meere finall cause. For the finall cause, so farre conceiueth then in the intention of the Agent: then must enquiry be made againe what the Agent should be, and so will the probleme rest vncleered. 1. Because one parcell of the Aire could not moue another, except the same were first moued it selfe, and so a new Agent must of necessity be found out. 2. The Agent and the thing moued or Patient, ought to be two sepa- rate and distinct bodies: But the parts of the ayre meeting to- gether, become one continuatue body. No shift is there left for these Philosophers but one distinction, wherein they distin- guish betwixt the *Vniuersall* & *Speciaall* forme. The Aire, as they affirme, according to his *Speciaall* forme, ascends vpward from the Center of the *Earth*: yet by the *Vniuersall*, for the conser- vation of the whole yniuerse, it may sometimes suffer a contrar- y motion, as to moue downward toward the Center. In which distinction they suppose they haue cut the throat of all contrary reasons. But who so vnderstands himselfe, shall finde it but as a weake reed, to hurt his hand which rests on it: for a seconde enquiry will be made, what this vniuersal forme should be. For by it they vnderstand of necessity either an *Internall* forme or Nature; or an *Externall* resuallance and harmonie of the parts, such as we haue described in the first Chapter of this booke. If they vnderstand this latter, it cannot any way bee a cause of this motion; because it followes and ariseth out of this motion concurring with the rest, & no way precedes it: where- as on the contrary part every caule is to goe before his effect: Secordly, this vniuersall forme or nature compared with the speciaall, there would arise a *Subordination*, and not a *Coordina- tion*.

the least ponderous. Yet we deny not but the Water and Aire, being settled in this wise, are in their naturall places; which to vnderstand, we must repeat what we said before, that Nature hath a twofold *intention*; the one *primarie*, the other *secondarie*. Indeed if we consider Natures primary or speciall inclination in the bodies themselues, we shall finde them (as we said) immediatly directed to the center as neare as might bee: but the *secondarie* intent of Nature was, that the bodies should so settle and conforme themselues, as that each of them should obtaine a place according to his degree of massenesse and waight. Out of this may be answered a certaine obiection which some haue produced, to proue the Aire to be absolutely light in his owne nature. Experience teacheth vs (say these men) that a bladder blowne vp with wind, or an empty barrell being by force kept vnder water; the force and obstacle omitted, will suddenly ascend to the top; and that a man ready to sinke in the Water, will not so easilly sinke downe while he can hold his breath: all which effects they ascribe to no other cause, then the inclination of the Aire to moue vpwards from the center. But indeed this motion, howbeit agreeable to the vniuersall nature and consistency of the Spheare, is notwithstanding in respect of the Aire it selfe, vnnaturall and violent; because this ascent of it is not caused by the forme of the Aire, but the interposition of a heauier body striuing for the same place, and so reverberating it backe from the place, whereunto it tended. For here it is to be imagined, that the bladder or empty barrell drowned in the water, claimes and injoyes for the time that place or distance, which otherwise so much water should occupie; to wit, so many inches of feet from one side to the other. No maruell then that obstacles remoued, the Water being most ponderous and waughtie, receiueth his own right; and (as it were) shoulders out the Aire, and violently driveth it off to his owne habitation. Whence many haue imagined that this motion is proper and naturall to the Aire, when of it selfe it is merely violent, and enforced by the interiection of another body more waughtie & ponderous then it selfe.

7 In this conformity of the Terrestriall parts, two things are to be obserued: 1 The center it selfe: 2 The parts which conforme themselues vnto it. The Center is an imaginary point in the midst of the Terrestriall Globe, to which all the parts are conformed.

The Fathers of the Mathematical Sciences, haue laboured to deriuē all their doctrine from a point, as the first and most simple principle wheron al the rest depend. Not that they imagine a point to be any positiuē entity in it selfe; but because it is the first bound of magnitude, whence all terminated quantities take their originall. The first principle we may call it, not of naturall constitution, because a thousand points collected, could not be so compounded, as out of it should arise the least magnitude; for (as the Philosopher hath taught vs) continuall and diuisible things cannot be made out of such things as are merely discontinuate and indivisiblē, but because it is the first Mathematical principle or beginning of termination and figuration. This point, although it haue every-where an use in Geometrie, yet ne-where more remarkable then when it becomes the center of a circle: which center we ought not to imagine a mere Geometricall conceit, but such as findes ground in the Naturall constitution of the Terrestriall Spheare. For seeing all terrene bodies are carried in a right line as by a Radius to one point, from every part of the circumference; we may obserue a center as it were designed and pointed out by Nature it selfe in the Globe: Some haue heare distinguished betwixt a point *Physicall*, and a point *Mathematicall*, as allotting the former *Latitude*, and sensible existence; but making the other merely *Indivisible*. But if the matter be rightly vnderstood, they are not two points, but all one, distinguished onely by a diuers name of conceit or consideration. For we consider first a point as it is existent in a sensible particular body, and so we cal

it *Physical*. Secondly we abstract it from this or that body sensible; but alwayes couer it withall to be in some body, and in this sort we terme it *Mathematicall*; for the Mathematician abstracts not a *Quantity* or *Quantitatine* signe from all subiects; for so being an accident, hee should conceiue it abstracted from its owne nature; but from this or that sensible body, as wood or stone. Such a point ought we to imagine the center of the Earth to be, not participating of any latitude or magnitude, albeit ex-
istent in some magnitude. I am not ignorant that some Writers haue taken a *Physical* point for a small, and insensible magnitude, in which sense the *Globe* of the Earth is called the center of all heauenly motions. But this sense is very impropere; and besides in this example is to be vnderstood a point *Opticall*, as such as carries no sensible or proportionable quantity in regard of the sight. Taking then the center of the Earth to bee a point fixt in the middest of the Earthly Spheare, as we haue described, we will further describe the nature of it in two Theo-
remes.

¶ *The center of the Earth is not an Attractiue, but a meere Respectiue point.*

An *Attractiue* point I terme that, which hath in it a vertue or power to draw and attract the Terrestriall parts or bodies, in such sort as the Loadstone hath a power to draw iron or Steele. But a *Respectiue* point is that, which the Bodies in their motions doe respect and conforme themselues vnto, as the bound or center to which their course is directed. Which may be illustrated by the *directive* operations of the Load-stone (which we shall hereafter handle) by which the *Magnetical Index* or needle pointeth directly Northward: not that in the North is fixed any Attractiue vertue or operation, which might cause that effect; but because the Magnetical Instrument is directed towards such a point or center. That the Center of the earth hath no Attractiue force, may be proued, 1 Because it cannot in any probability be thought that an Imaginative point hauing only a *privative* Being & subsistence, should challenge to it selfe any such operation. For all *positive* effects, proceed

out of positive causes, neither can it be imagined that this Attraction should grow out of a ~~metia~~ privation. Secondly, should this be granted, that the motion of Earthly parts should be from the Attractive vertue of the Center; it would follow necessarily, that this motion should not be Naturall, but violent; as proceeding from an external cause, which all ancient and moderne Philosophers deny.

2. *The same point is the center of Magnitude and waight in the Terrestriall Spheare.*

That the same point in the Terrene Globe, should make the center both of *Magnitude* and *Waight*, may seeme very plain; Because wee are not to multiply things and Entities in our conceit, without any necessary consequence drawne from Nature or Reason, enforcing vs thereunto. But what reason could euer perswade any man, that the Earth had two Centers, the one of *Waight*, the other of *Magnitude*, but only a bare Imagination, without proofe or demonstratiō. Secondly, if this were granted, that the Center of magnitude were remoued some distance from the other; then consequently would one part of the Earth ouer-poize the other in ponderosity, & so the whole Spheare would either be shaken out of its place, or dissolve it selfe into its first principles. Both of which being by experience contradicted, our assertion will stand sure and vndoubted. In the meane space, we deny not but that some litle difference may be admitted in regard of the unequall parts of the Earth; but this must needs be so small and insensible as cannot bee calculated, or cause any alteration.

3. *The Terrene parts conforming themselves to this center, may bee considered two wayes; either Absolutely, or Comparatiuely.*
Absolutely, as euery part is considered in it selfe.

4. *A terrestriall part considered in it selfe, undergoes.*

dergoes the respect either of a Point or Magnitude; as a point, when any signe or point in it selfe is considered in regard of his conformity to the center.

A Point, albeit existing still in some magnitude (as we haue shewed) may notwithstanding be abstracted from this or that body, as seruing for the center of any body, whose naturall inclination and conformity to the vniuersall center of the Earth, we may in the first place handle, as the Rule by which the motion and inclination of the whole magnitude ought to bee squared.

¶ Every point or center of a waightie body, is moued toward the center of the Terrestriall Spheare by a right line.

A Right line is the measure and rule almost of all *Naturall* actions; which albeit it be familiar in almost every operations; yet most of all in the motion of the Earthly bodies tending to the center of the Earth. Why *Nature* in this kind should chiefly affect a *Right line*, sundry reasons may be alleaged: 1 From the *End* which *Nature* doth propose it selfe, which is to produce the worke which shee intends, the readiest and shortest way; as *Aristotle* testifies of her in the 5 of his *Metaphysickes*. Now it is manifest that a Right line drawne betwixt the same points, is alwayes shortest, as *Euclide* shewes in his *Elements*; where hee demonstrates that two sides of any triangle being counted together, are longer then the third. The better to understand the working of *Nature*, we shall obserue in the motion of a heauy part to the center, a double scope or end; first, that the said part of a *terrestrial* body, should be moued or separated from the place to which it is by violence transposed. Secondly, that this body should bee restored home, and united to the *Spherical* substance of the Earth, in which it must chiefly seeke its preservation. That these two ends are best and soonest compassed by a right line is most manifest: For first a sep-

paration from the place to which it is moued, is more quick & expedient by a right line; forasmuch as crooked and circular lines, turne backe as it were into themselues againe. Also the vision and coniunction of a part with the *Sphære* of the *Earth*, is most indebted to a right motion, because (as we haue declared) the way is shorter. Secondly, it may be alleaged, that *Nature* is an *uniforme* and necessary Agent, restrained to one only bound or end, and therefore can neither strengthen, weaken, remit or suspend the action, but workes alwayes by the same meanes, the same effects; whence it is that sliue cluseth a right line, being but one betwix two point; whereas crooked lines may bee drawne infinite, and the motion directed by crooked lines would prove various and opposite to the prescript of *Nature*. Moreover should we imagine that nature at any time wrought by a crooked or circular line, it might be demanded, from what Agent this obliquity should arise? not from *Nature* it selfe: because (as we said) shee worketh alwayes to the vtmost of her strength, hauing no power to remit or suspend her actions. But a crooked motion ariseth from the remission or slacking of the Agents force, and turning it away from the intended end, which onely findes place in Free and *voluntary* Agents. Neither comes this Deflexion from the medium, or Aire, because it can haue no such power to resist. Thirdly, if the motion were not performed in a right line, it could haue no opposite or contrary; because (as Aristotle teacheth) *To a circular or crooked motion, no other motion can be opposite or contrary in respect of the whole circle, but onely in regard of the Diameter*, which is alwayes a right line. By this it is plaine, that a maughty point considered in it selfe abstractly, cannot but be carried to the center in a right line: which right line, *really* and *Physically*, points out unto vs a *Radius* or *Beame* drayne from the center to the *circumference*, to shew that the God of *Nature* in composing the earthly globe, both obserued and taught vs the vse of *Geometrie*.

• de calo
sp. 4.

2 A point moving toward the Center, will moue swifter in the end, then in the beginning.

This hath bin plainly obserued by experiance, that a stone

let fall from a towre or high place, will in motion grow swifter and swifter, till it approach the ground or place whereon it falls. The reason may be giuen from the *Aire*, which resists so much the lesse, by how much the body descendeth lower toward the *Earth* or center; because when it is higher, the distance being greater, the parts of the *Aire* will make more *Resistance*. The reason rendred by *Aristotle* of this *Resistance*, is, because in the beginning of the motion, the stone or heauy body findes the *Aire* quiet and *fixed*: but being once set on motion, the higher parts of the *Aire*, successiuely moue those which are vnder, being driuen by the violence of the stone so falling, and prepare, as it were, the way for his comming. This reason may in some sort content an ingenious wit, till a better be found out.

10. So much for the motion of a heauy point or center: it remaines that we treat next of the motions and conformity of *Magnitudes* to the center of the *Earth*: wherein wee consider not onely the *Center* or middle point, but the whole masse of the magnitude, whose motion and conformity shall be expressed in this Theoreme,

1. *The motion of a magnitude toward the center, is not meereley naturall, but mixt with a violent motion:*

This may easily be demonstrated; because no point of any magnitude is moued to the *Center* naturally, but the *middle point* or center of the magnitude: For although the *Center* be moued in a *perpendicular* line, which makes right angles with the *Horizon*; yet the *extreme* parts are moued in lines *parallel*, which cannot possibly make right angles with the *Horizon*, or meet in the *Center*; which may bee shewne in this Fi-

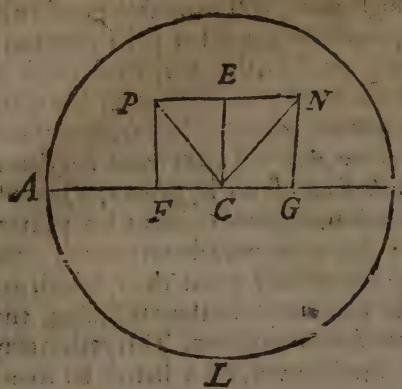


figure: Let there be a Circle as A B L. This done, wee will imagine a certaine magnitude hanging in the Aire, and tending to the Center C, which is signified by the line P E N. It is certain that the Center of the magnitude E; will moue and conforme it selfe downward toward

the center of the Earth by the line E C, which motion wil bee *naturall*, as that which is derived to a center from a circumference by the direct *Radius*; which is the Rule of all naturall motions: But the other parts without the center of this magnitude, cannot moue but in so many lines, which shall be *parallel* the one to the other: as for example, the point N must needs moue in the line N G, and the point P in the line P F, which being of equall distance, will never concurre in the Center, and therefore cannot bee esteemed *naturall rayes* of the circle; whence we may collect, that the motion of these parts is not *naturall*, but *violent*: for if any should imagine the motion of these parts to be *naturall*, then should the point N moue to the center of the Earth by the line N C, and the point P by the line P C; and so by how much the more any waighty body should approach the Center of the Earth, by so much it should be diminished and curtailed in his quantity: so that in the Center it selfe, all the parts should concurre in an *Indivisible* point, which is absurd and contradicts all reason.

Hitherto haue we spoken of the confor-
mity of all Earthly and waighty bodies to
the Terrene center, as they are taken *Absolu-*
tely.

lately. It now remaines that we speake of these bodies as they are taken *comparatiuely*, being compared one with the other.

This discourse properly belongs to an art which is called *Statick* and is *Mathematicall*; whose office is to demonstrate the affections of *Heauinesse* and *Lightnesse* of all Bodies out of their causes. The chiefe sensible Instrument whereon these properties are demonstrated and shewne, is the *Bilanx* or *Ballance*. But these specialties wee leauie to such as haue purposelly written of this subiect: amongst which the most ancient and chiefe is *Archimedes*, whose heauenly wit ouertooke all such as went before him, and out-went all such as followed. Enough it will seeme in this Treatise to insert a proposition or two *Staticall*, to shew the *Conformity* of two magnitudes, and their proper Center, mouing downward toward the *Globe* of the *Earth*, & it's Center.

- I. The lines wherein the centers of two heauy bodies are moued downward, being continued, will meet in the Center of the Earth.

A heauy point or Center (as we haue demonstrated heretofore in this Chapter) is moued toward the Center of the world in a right line, which is imagined to bee a *Ray* of the whole Spheare deriu'd from the circumference to the Center, & therefore it is impossible they should be parallel or *Æquidistant*, but concurrent lines. But because the whole distance betwixt vs and the Center is very great; it must needs happen that in a small space the concourse of perpendicular lines is altogether insensible. For if two perpendicular or heauy points moued in a line, should be distant one from the other the space of 10, or 100. or more feet; because this distance is very little in respect of the *semidiameter* of the *Earth*: the angle of concourse must needs bee very little, and by consequence those two rayes or lines, measuring the descent of two heauy Bodies, will seeme altogether *Æquidistant*. Yet that there is such a concurrence, *Nature* and *Reason*.

Reason will easily consent. Hence we may detect a popular error beleueed of the vulgar, that the walls of houses standing upright are parallel and of equall distance; when contrariwise it is plaine that such walls are erected by a perpendicular, and measured by perpendicular lines, which being drawne out in length will meet in the Center of the Earth. The like may wee pronounce of a deepe Well, whose sides or wall are erected perpendicularly; and therefore should it reach as farre as the Center, it must needs follow that the sides growing nearer and nearer as they approach the Center, would in the end close or shut up into a Pyramide, whose Base should bee the mouth of the Well. Likewise if a Tower should be erected to the Heauens, it would be strange to imagine, how great and broad the vpper part of it would be in respect of the bottom. Hence againe it may be inferred, that any pauement leuelled by a perpendicular is not an absolute plain, but rather the *portio* or Arch of a *spherical superficies*, whose Center is the same with the Center of the whole Earth. But this roundnesse in a small distance is no way sensible; but in a great pauement of foure or five hundred paces leuelled perpendicularly; it will make some shewe of roundnesse: whence it must needs follow, that an extraordinary great pauement measured ouer by a right line, cannot be called leuell or equally poized, forasmuch as it is not every where equally distant from the Center of the Earthly Globe.

2. Two heauy bodies of the same figure and matter, whether Equall or Vnæquall, will in æquall time moue in an equall space.

This proposition being inuented by one *Johannes Baptist de Benedictis*, is cited and confirmed by *John Dee*, in his Mathematical Preface to *Billingfie's Geometry*. Which corrects a common error of those men, which suppose the lighter bodies generally not to moue so fast downward to the Center as the heauy. The demonstration of this Theoreme, being drawne from many *Staticall* principles, which wee cannot here conueniently insert, we are enforced to omit; as intending not the search of these matters any farther then they direct vnto the knowledge of

of *Geographie*. Yet were it no hard matter to give a more popular explication of this reason out of the proportion betwixt this weight of the heauy Body, and the Resistance of the Medium. Because the Greater Body, as it is carried down-ward by a greater force and violence; so on the other side it meets a greater impediment, being not able soone to diuide the Aire, as the Lesser: Likewise the Lesser body falling with lesse force, yet is more apt to diuide it then the other. Whence both set the one against the other, there wilbe no disparity in the time and motion.

12. Of the primary conformity of the Terrestrial bodies in the constitution of the Terrestrial Sphære, we haue treated: It now seemes needfull that wee descend to the secondary, which is the inclination of all the parts, to make a round Sphære or Globe.

I. *The Terrestriall Globe is round and Sphericall.*

This Proposition is of great vse, and one of the chiefeſt grounds in *Geographie*. The ground of the Sphericall figure of the Earth, is the right motion of heavy bodies to the center. For this right motion (as we haue shewed) doth exprefſe one Beame of the circle, by whose circumvolution is produced the circumference of it, which we call *Secondary conformatiōe* of the parts of the Earth; infomuch as it growes Mathematically (as it were) out of the first. For this Sphericall figure of the Earth, ſundry ſound reaſons are vrged by *Geographers*: First, that the Earth is round according to its *Latitude*, that is, from North to South. Secondly, according to its *Longitudo*, that is, from East to West, and therefore muſt it needs bee absolutely Sphericall. The firſt part is ſhewed, that it is round from North to South; for if a man trauell from North to South, or contrariwise from South to North, he ſhall perceiue new ſtarres in the Heauens to appeare and ſhew themſelves, which before he

could not see: which can be referred to no other cause then the Spæricall convexitie, or swelling of the Earth. As for example; The starre which is called *Canopus*, which is a notable starre in the ship; appeares not at *Rhodes*, or at least from high places. But if you trauell forth Southward from *Italy* into *Egypt*, to

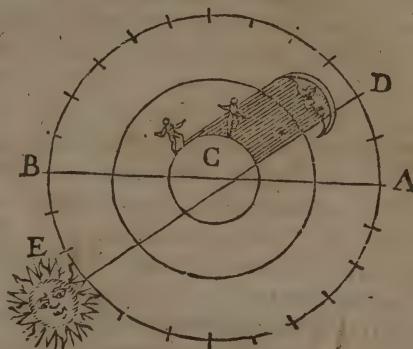
L. de sphaer. *Alexandria*, the same starre (*Proclus* obserues) will manifest it selfe to your sight the fourth part of a signe aboue the *Horizon*. From whence wee may draw a sound prooфе, that there is a Sphæricall and gibbous convexitie, which interposeth it selfe betwixt *Rhodes* and *Egypt*. In which place, the people which inhabite that part of *Egypt*, which borders vpon *Arabia*, which are called *Troglodites*, of their dwelling in caues, cannot see any Starre of the *Great Beare*. Whence we may conclude, that the Earth from the North to the South, is round and Sphæricall. For if otherwise the Earth were *plaine*, all the Northerne starres would appeare to the inhabitants of the Southerne Regions; & on the other side, all the other Southerne constellations would be scene of the Northerne inhabitants, which sense and reaon altogether contradict. Secondly, that the Earth is round according to its *Longitude* betwixt East and West, may be proued by two reasons. The first is taken from the rising and setting of the *Sunne*, *Moone*, and other Starres, forasmuch as all they doe not arise or set with all Nations at the same hours. For with the inhabitants of the East, the Sun-rising is sooner; with the Westerne inhabitants later; and that in such proportion, that euery 15 degrees measured out by the Sunnes diurnall motion, adds or subtracts one whole houre in the length of the day. This is found by experience and testimony of *Cosmographers*, that the *Sunne* riseth with the *Persian*, inhabiting toward the East, foure houres sooner then to the *Spaniard* in the West. Sundry other the like examples may be alleged; all which we must needs impute to the Sphæricall roundnesse of the Earth, proportionally increasing betwixt East and West. The other reason to confirme this last point, is drawne from the *Eclipses* of the *Sunne* and *Moone*, which would not appeare in diuers places, at diuers houres, if the Earth were *plaine* or *square*. We see plainly that *Eclipses* of the *Moon* appeare sooner to the

Westerne

Westerne people, but later to the Easterne. As (according to *Ptolomie*) in *Arbela* a towne of *Assyria* (where *Alexander* overcame *Darius* the last King of the *Persians*) was there observed an Ecclipsē at the fifth hour of the night, which selfe same Ecclipsē was seene in *Carthage* at the second; which to any man appears plainly in this figure here inserted. In like manner an Ecclipsē of the Sunne at *Campania* which was obseru'd betwixt 8 and 9; was (as *Pliny* reports) seene in *Armenia* betwixt 10 and 11 of the clocke. Whence may be gathered that this difference of appearance arose from the roundnesse of the Earth, interposing it selfe betwixt these

Lib. 1. *geog.*
cap. 4

Lib. 2. c. 72.



two places. Another reason to proue the Spherical figure of the Earth, is drawne from the Ecclipsē of the Moone, wherein the obscured point is described by a Spherical figure, which must needs argue, that the body which causeth the shadow, is also round. For as the Optickes teach vs, the shadow is wont to follow and imitate the opacious body whence it proceedes, and all men confesse that the Ecclipsē of the Moone is made by the interpositiō of the Spheare of the Earth betwixt the Sun & Moon, intercepting the beams of the Sun, which should illustrat & lighten the Moone. The third reason may be taken from the absurdities which would follow, should we admit any other figure besides. For granting it to be plaine (as some of the *Platonists* haue imagined) it would necessarily follow in reason; 1 That the *Elevation* of the Pole would be the same in all the parts of the Earth. 2 That there would be the same *face* and appearance of the Heauens in all places. 3 That the Sunne and Moone, with other starres, would in all places arise alike at the

E a same

same hours. 4 That all *Eclipses* would appeare to all places at the same hours. 5 That the same *quantitie* of dayes & nights would bee at all places. 6 That the *shadowes* would be every where al ke; and one Region would not bee hotter or colder then another, all which would plainly stand opposite to reason and experiance. As many or more would proue the absurdities of those, that ascribe to the Earth any other figure then Sphæricall. Which I willingly passe ouer, as not willing to fight with shadowes, and faigne an opposition, where I scarce finde an aduersarie. These reasons are sufficient to proue, that the whole masse of the *Earth* is *Sphæricall*. Divers other popular arguments may be drawne from the *finall* cause to countenance this Assertion. For no other figure can be assigned to the Earth, which can more vphold the order of Nature, or speake the wisdome of the Omnipotent Creator. 1 Because such a Figure would best beseeme the Earth, the seate and dwelling-place of all living Creatures, which is most capable: because otherwise the God of Nature would seeme to doe something in vaine, & without cause: Forasmuch as the same *capacity* might be confined within stricter bounds. Now it is apparent to all *Mathematicians*, that amongst all those figures which they call *Isoperimetrall*, a *Circle* is the most *capable*, & amongst the rest, those which approach nearest vnto a *circle*. And as wee esteeme of a *circle* described in a plaine surface, so must we iudge in *solides* of a *Spheare*. Which profitable Geometry of Nature wee shall finde instill'd into most living Creatures, who by a certain *Naturall Instinct*, without the vse of Reason, make their Nests and resting-places of a *Sphæricall* Figure, as most convenient, and of greatest capacity; as experiance shewes vs, in the Nests of Birds, and Bee-Hiues, wherein the cells are fashioned round & *Sphæricall*. 2 We shall find the Holy Scriptures consonant to this opinion in diuers places; but that it might seeme impiety to vse those sacred helpe in a matter out of controuersie, and needing no such Demonstration.

2 *The rugged and vnæquall parts of the Earth, binder not the Sphæricall roundnesse of it.*

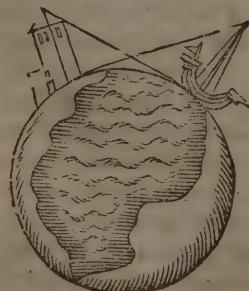
It is thought by ignorant people, that the Earth is not round, because of the rugged and vneuen parts of the *superficie* of it: For some-where it swells with great and high *mountaines*, *rocks*, and *hills*; Other-where it seemes indented, and (as it were) trenched into *valleyes*, & *concavities*; all which seeme to detract from a true Sphæricall *superficie*; because in such a one, every line drawne from the Center to it, should be æquall one to the other. Indeed that the *Globe* of the Earth is not *Absolutely* and *Geometrically* round, as an *Artificiall* Spheare, is *cōf. sed by Eratosthenes*, cited by *Strabo* in his 1 book of *Geographie*; whence *Pliny* in his 2 book, cap 21: saith, that the *Earth* & *Water* make one *Globe*, not so absolutely round as the *Heauens*, but much different, as also *Strabo* confirmeſ. This propoſition depending on these 3 reasons which follow, will shew that this *Inequality*, how great soever it seeme to the sight, is altogethers *insensible*, and bearing no proportion with the huge *vastnesſe* of the whole *Earth*: The first is taken from the *perpendiculare hight* of the greatest and highest mountaine, which is ſeldome or neuer found to exceed 10 miles, (although few *Mathematicians* will grant ſo much) whereas the whole *Diameter* of the *Earth* containes no leſſe then 7200 *English miles*; ſo that these hills compared to the *thicknes* of the *Earth*, are but as 10 to 7200: which indeed hath no *sensible proportion*. The ſecond is taken from the *Ecliptice* of the *Moone*, which being caused by the shadow of the interpoſed *Earth*, is described by a *Sphæricall* figure, without any *vnaequall* or *rugged* parts, which no doubt, would appear, if these parts challenge any due proportion, or ſensible quantity, in respect of the whole *Earth*. Thirdly, ſome haue illustrated this by a round *bowle*, or *ball*, whose *externall surface*, although *vnaequall*, and *indented* here & there with *scotches*, other-where ſwelling with *knobs*, will notwithstanding being interpoſed betwixt the *ſun beame* and a *wall*, or ſuch *face*, giue a round or *Sphæricall* shadow in the ſame *wall* or *plaine*, in regard of the little quantity of these ſmall parts in respect of the whole *Body*. In like ſort muſt we imagine the *mountaines* and *vnaequall* parts in the *face* of the *Earth*, to be no otherwife then as ſo many *warts* or *pimples* in

Lib. I.

the face of a man , which cannot alter his due proportion or symmetry of the parts.

3 The Water concurring with the Earth in the Globe is also Sphaericall.

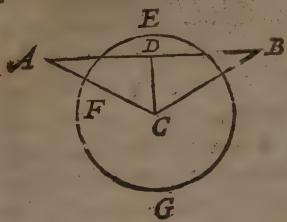
It is a proposition agreed on by *Archimedes*, and almost all the ancient *Mathematicians* of any note, that the *superficies* of the Water, or any other liquor, standing and subsisting quietly of it selfe, is *Sphaericall*; whose center will be the same with the center of the whole *Earth*, which we are here to handle, because it appertaines to the making vp of the *Terrestriall Globe*; although wee shall haue occasion hereafter to speake specially concerning the *Water* in *Hydrographie*, in the second part of this *Treatise*. The reasons to confirme this assertion , beside those that in generall proue the *Sphaericity* of the *Terrene globe* are diuers: 1 It is obserued that *Passengers* in a *Ship*, lanching out into the deepe from some *Hauen* , will first perceiue the *Towres*, *Buildings*, *Castles*, *Promontories*, and *Trees* standing on the *land*, in their perfect figure and greatnessse: sayling farther off, they will obserue them on the lower part, little & little diminished, vntill such time as the tops only of the houses and trees will be *visible*. In like sort they which tarry on the *Land*, will first espye the top and mast of a *Ship* approaching, which sight will be perfected more and more, as the *Ship* drawes toward the *land* , and at last all parts of it will shew themselues; which accident can be cast vpon no other cause, then the *Sphaericall roundnesse*, and swelling of the water ; which, if the distance be great, interposeth it selfe betweene the station on the *Land* and the *Ship* wherein *Passengers* are conveyed, which experiment is expressed in this *Diagramme* here annexed. Certaine *Platonicks*, of which the chiefest is *Patricius a late Writer*, would ascribe this



this experiment to the impediment of the sight, caused partly by the distance which cannot perfectly represent the object, partly by the interposed vapours arising in the Sea; partly by the quivering light which is spread by the refraction of the Sun-beames in the water. I deny not but these causes may somewhat hinder, and cause that the true and perfect *species* of a body cannot alwaies visit the sight. Yet will it be euident that this is not all, but that the *spherical* roundnes of the water will proue a greater impediment where the *distance* is anything greater. But for one of *Patricius* his shifts concerning vapours arising out of the Sea, (to which *Clavius* seemes also to consent in his Commentary vpon *Iohannes de Sacrobosco*) it makes more for our assertion then his. For that which is seen in a thick *medium*, according to the doctrine of the *Opticks*, seems greater in quantity, and by consequence neerer, and so higher then would otherwise appeare: as we see by experience, that the *Sunne* sometimes is seene of vs before it ascend aboue the *Horizon*, because of a refraction of it's beames in a *thicke* matter. Wherefore it were rather to be imagined, that a tower seen at Sea, or a ship from the land, through these *thicke* and *grosse* vapours, should appeare higher, and seeme neerer then if it met not with such vapours. Secondly, what is vrged concerning the trembling *light*, caused by a refraction of the Sun-beames in the water, is of no force: For although such a light might cause an impediment or hinderance to the sight; yet would not this decrement or hinderance bee by degrees and in such proportion as we find it to be correspondent, to wit, to the distance interposed. And much wonder it is that *Patricius* (as my learned Friend Mr. R. Hues obserues) being, as it seemes very well read in the stories of *Spanish* nauigations, should not be conuinced out of the Nauigation of *Magellane*, who taking his iourney toward the *Southwest* parts, passed by the *Magellan* straights, now called by his name, and so returned by the *Cape of Good Hape* into *Spaine*, to which we may adde the voages of *Drake*, *Candish*, and many others. The second reason is vrged by *Aristotle* in his 2^d book *de cœlo*, and hath its ground in *Archimedes lib. 1. de Aqua-ventis*, which is formed in this.

forte.

sort. The nature of the water is to affect and flow to the lower place, whence it must necessarily be inferred that it must bee round, for otherwise it should not alwaies obtaine the lower place. The reason of the consequence shall be expressed in this



figure; for if we ascribe to the water a plain superficies, let it for example be A D B, and from the center of the earth C, let there be described a circle, to wit, E G F, then let there be drawne C D, a perpendicular line to A B, and let A C and B C be ioyned together. Now be-

cause the right line C D is lesse then C A, or C B, as wil appeare evidently by sense; it will be plaine that the point D will be in a lower place then the point A or B, because D is nearer to the Center; forasmuch as D C is but a part of a beame of the circle whereas A C and C B evidently exceed that quantity or proportion. Another reason there is, commonly drawne from the roundnes of drops cast on the land, as also from water in pots, whose superficies seemes to swell aboue the brimmes; but this reason, as we shall proue in place conuenient, is rather against this assertion then for it; because indeed, wee affirme the water to be round, but so as it claimes the same Center with the Center of the Terrene Globe; and therefore cannot be sensible in so little a portion, as a drop, or pot of water. This proposition being sufficiently proued by these two reasons; it is needfull in the seconde place that we answere certaine objections cast in by the said *Patricius* against our assertion. Every surface of the water (quoth *Patricius*) is either only plaine, or only round, or both plaine and round, or neither plaine nor round: First that it is not both plaine and round, seemes very evident, for so it should admit of contrariety: Neither can one part be plaine and another round, because the water is an vniforme and homogeneall body, not consisting of such vnequall parts: that it should neither be plaine nor round seemes more impossible, because few or none haue dreamt of any other figure. Lastly, that it is not round only, he labours to confirme by sundry reasons

sons and experiments. First, he testifies of himself, that sayling in the Sea, he plainly saw in the morning before Sun-rising, the Mountaines of *Corsica*; which afterward, assoone as the Sunne was risen, vanished out of his sight. Whence he concludes, that this proceedes not from the roundnes of the Earth, but from some other cause. But this argument to iudicious men wil seeme very weake, 1 Because it depends altogether on the authority and credit of *Patricius*, whose assertion I take to be no better then another mans denial. 2^{ly} were this argument every-where found, yet would it proue no other thing, but that this effect were not to bee imputed to the Sphæricall swelling of the Earth. Whence cannot be drawne any generall conclusion, that the *Earth or Water* is not *Spheritall*. We deny not in the meane time, that other causes sometimes concurre, which may hinder or take away the sight of obiects from those which saile on the Sea. The second experiment, *Patricius* describes in this manner. At a certaine Towne called *Comaclum* (saith hee) there is a very great poole; through which poole or lake some 3 yeares agoe, it was my chance to be carried in a boat. The bottome of the water almost all the way in all the iourney appeared to be leesse then 2 foot in depth from the top. The way increasing, at first the lower parts and foundations of houses, then the tops and princely pinnacles began to vanish from our sight: at last hauing scarce passed 6000 paces, a Tower 72 foot high began to appeare, as it were cut off by the middle, & from the middle part vpward appeared visible; but after 10000 paces it was taken out of sight: I would here aske the *Geographers* (quoth *Patricius*) whether in so short a distance, wherein the bottome for the whole space surpassed not two foot in depth, the water could ascend to 72 foot? Had it bin my chance to haue gone with *Patricius* ouer the lake, I might perhaps by obseruation of this experiment, haue giuen a more probable conjecture of the cause. Neuerthelesse being vnacquainted aswell with the place, as the truth of his obseruation, I may perhaps guesse somewhat at his error. First then, whereas he averres, that passing along for the space of a 1000 paces, a *Towre* of 72 foot high, seemed cut off by the midst, which at 10000 vanished

out of sight. I confess that in so short a space the swelling of the water inter-posed, could not be so great as to hidder the sight, and be the cause of this effect: wherefore some other ~~accidental~~ cause must be sought out. For the finding out of which to come as neare as I can, I would make inquiry, whether this passage of the *Boat* was directly *forward* from the *Towre* on the *Water*, no land inter-posed: or *Indirectly* side-wise, in such sort, as the shore might be placed betwixt their sight and the *Towre* mentioned: The former no wayes can be imagin'd; forasmuch as it not only contradicthes the grounds of our received *Philosophie*; but also of *Patricius* himselfe: for giuing the *Earth* a *plaine* surface, or *Angular*, or any other forme, it were impossible that in so short a distance, such an effect should happen out of the figurature of the water. If the passage were *oblique* or *indirect*, in such wise as the shoare might any way inter-pose it selfe betwixt the *Boate* and the *Towre*, it were easie to imagine how such an experiment should happen: for the land by which the *Boat* might be carried, might haue an ascent by such *Degrees*, as the *Towre* at 1000 paces might be for the halfe of it obscured, and at last be al together taken out of sight. This reason then of *Patricius*, seemes rather to be ascribed to the *Land* then the *Water*. The third reason of *Patricius* is drawne from the *Homogeneity* of the *Water*. If the *water* (saith he) haue a round *superficies*, the parts of it would challenge the like figure, because in *homogeneall* bodies, the same reason is to be giuen of the *whole*, and of the *parts*: But the parts of the *water* are not *Sphaericall*, as may be proued by diuers instances: 1^{ly} Because *water* in the mouth of a *pot*, seemes not to haue any such *Sphaericall* roundnes: for although at the *brinke* it seeme to bee restrained aboue the *pot*, yet no such swelling appeares in the *middle*. 2^{ly} That *riuers* are keptin by their *bankes*, which otherwise would flow abroad. 3^{ly} That *riuers*, when by the melting of *snow*, they swell so great, as they can hardly be contained within their *bankes*, doe not seeme higher in the *middle*, then in other places. 4^{ly} If any man from one side of the *riuer* to the other, leveles at any mark, he may surely hit it: which he should not doe, if there were any *Sphaericall* swelling in the *midst*,

midst, which might hinder the sight. ^{5^{ly} and lastly it seemes so vnlikely, that the water should rise in the midst, that it is more probable it should be more hollow; in that we plainly obserue that all filth and rubbish carried from the bankes into the riuier, is wont to settle and swimme in the midst. Notwithstanding all these arguments of *Patricius*, our ground is yet vnshaken; ¹ Concerning small drops, and water in the mouth of pots; it is found to be round and Sphæricall, though not exactly: the reason whereof we shall declare hereafter. This roundnesse, I confess, serues not any way to the confirmation of this assertion, because the *Sphericity* and roundnes which we averre to be in Water, hath for its center, the center of the whole Earth: and therefore in so small an arch or section, as the breadth of a pot, or a drop of water, cannot possibly haue any sensible appearance or existence. And we must needes confess, that this experiment was very fondly vrged to this purpose by some of our *Geographers*, and such as stands not with any demonstration. Which granted, sufficiently answeres all the reasons last vrged by *Patricius*, except the last. Forasmuch as he requires in the Water, a sensible appearance of this roundnesse in every riuier or little parcell of water, which cannot be admitted. Touching the last thing which he vrgeth, that all the rubbish and filthy matter, is from the bankes carried into the middle, whence he would inferre the middle to be hollow and lowest; we can answere diuers wayes: ¹ That this experiment is not alwayes certaine, because euery man may oftentimes see the contrary; to wit, that such filthy rubbish rather vseth to cleaue to the banks of the riuier, then to float into the midst. ^{2^{ly} That if any such thing happen, it is because of the torrents which run violently from the banks into the midst, carrying with it such things as are light, the steepnesse of the place being greater, the current wider or swifter. But nothing here can be concluded to proue the water according to his naturall force, to bee either plaine or hollow in the midst, which this Adversary yndertook to demonstrate.}}

C H A P. III.

Of the Partiall magneticall affections in the
Spheare of the Earth.

Hitherto haue we discoursed of such affections of the Terrestriall Spheare as are *Elementary*, and knowne heretofore to ancient Philosophers : It followes in the next place that we treat of *Magneticall affections*, to wit, such as follow the *magneticall nature of the Earth*.

Of the *vertue* and *propriety* of the *Load-stone* many haue written, but few sought out the true nature. The invention of it is attributed to a certain heards-man, who hauing his shooes shod with iron, and an iron pike in his hand, resting himselfe on a quarry of *Loadstone*, could hardly remoue himselfe frō thence. But this seemes rather a pleasant *Poeticall invention*, then a true History, hauing no good Author to auouch it. But to let passe the first Invention, being a matter rather indebted to *chance* then *industry*; no small difficulties haue discouered themselues in the invention and finding out of the causes of *Magneticall properties*. Somewhat, I confess, hath bin written of such magneticall affections as haue bin most knowne; such as is the vertue *Attrattive*, by which it drawes to it selfe iron, or steele; as also the vertue *Directiue*, by which a needle touched with the *Magnet*, directs and conformes it selfe North and South. The rest of *Magneticall proprieties* I find in ancient Writers, as little knowne as their causes; & if any matter herein were broached, it was merely coniectural, and depending on no certain demonstration; neither had we any certain or satisfactory knowledge

of this thing, vntill such time as it pleased God to raise vp one of our Countrymen *D. Gilbert*, who to his everlaſting praise hath troden out a new path to *Philosophie*, and on the Load-stone erected a large *Trophe* to commend him to posterity. This famous Doctor being as pregnant in witty apprehension, as diligent in curious ſearch of naturall causes: after many experiments, and long inquiry, found the causes of moſt magnetical motions and proprieties hid in the magnetical temper and conſtitution of the *Earth*, & that the *Earth* it ſelfe was a meere *Magnetical* body challenging all thoſe proprieties, and more then haue expreſſed themſelues in the Lead-stone. Which opinion of his was no ſooner broached, then it was embraced and wel-comm'd by many prime wits, aſwell *English* as *Forraine*. In ſo much that it hath of late taken large root, and gotten much ground of our *vulgar Philosophie*: Not that in the maine ſcope and drift of it, it contradicts or crosſes all *Peripateticall* principles, or the moſt part of ſuſh grounds as haue hitherto borne the ſtampe aſwell of *Antiquity*, as of *Authority*: But that it hath brought to light matters of no ſmall moment, which neuer found any ground or footſteppes in our ordinary *Philosophie*. This new *Philosophie* I dare not cōmend as euery-where perfect and absolute, being but of late yeares invented, and not yet brought to mature perfection: yet would it ſauour of little ingenuity or judgment in any man, peruerſely to deny all ſuſh *Magnetical* affections in the *Earth* as are grounded on plaine experiments and obſeruation: ſith no *Philosophie* was every-way ſo exact, but required experience dayly to correct it. I intend not here an absolute diſcourse of *Magnetical* Bodies and Motions, but leaue it to their ſearch whose experimentall induſtric is more ſuteable to ſuſh a ſubieſt. Onely I will ſhew ſome generall grounds appertaining to the conſtitution of the *Terreftriall Globe*, which I hold neceſſary for a *Geographer*. Whereforeere I curiouſly diſtinguiſh theſe *Magnetical* proprieties of the *Earth* into other ſeverall kindes, I will ſet down, this Theoreme, as a ground or foundation of that which fol- lowes.

I The Terrestriall Spheare is of a Magneticall nature and disposition.

A Magneticall Body by some is defined to be that which seated in the Aire, doth place it selfe in one place *naturall*, not alterable. This situation is supposed to agree to all the Starres, especially to the great Globes of *Saturne*, *Jupiter*, *Mars*, and the *Sunne*; as also to such as giue their attendance on them, lately detected by the Trunk-Spectacle; to wit, those two Starres which moue about *Saturne*, the soure which moue about *Jupiter*, the twy which circle about the *Sunne*, as *Venus* and *Mercure*; and lastly the *Moone*, which encompasseth the Spheare of the Earth. But to let passe those other Globes, as farther off, and therefore lesse subiect to our search: our discourse shall onely touch the Earth whereon we liue, which we shall proue to partake of a certain Magneticall vertue or inclination: which to shew more openly, we must vnderstand, that all Magneticall Globes haue some parts of their bodies which be also Magneticall, which being diuorced from their proper Spheare, & meeeting no obstatle, will settle themselues to the naturall situation of their peculiar *Orbes*. Which we may plainly perceiue in the Spheare of the Earth, wherein we shall find two Magneticall minerals; whereof the one is the *Load stone*, attracting iron or steele; the other the *Iron* or steele it selfe: either of these two, artificially hanged in the Aire, or placed in a little boat on the wa-ter, all incombrances being remoued, will conforme and settle their parts and Poles correspondent to the poles and parts of the Terrestriall Spheare, as *North* and *South*. This hath bin found in all parts of the Earth by such as haue trauelled round about her, as *Drake* and *Candish*, whose Compasses were alwayes directed Magnetically in all places which they passed: which we cannot ascribe to any other cause then the *disponent* faculty of the Earth's Magneticall Spheare, as shall appeare hereafter by demonstration. Moreouer it hath bin obserued by such as saile *Northerly* and *Southerly*, that the Magneticall *Inclinatorie* needle, in every elevation of the Pole is conformed and disposed to the Axell of the Earth, according to certaine angles answerable

to the latitude of the Region, as we shall shew hereafter. This diversity of conformity must necessarily arise, either from the *Magneticall* instrument in it selfe *absolutely* considered, or els from the *Harmony* and correspondencie it hath with the *Terrane* *Globe*. It cannot be the first; because it should be the same in all places and Regions of the *Earth*, which is contrary to experience, and our supposition. Then must we needs deriuē it from the *Magneticall* *disponent* *virtue* of the whole *Globe* of the *Earth*, from which vertue the whole *Earth* may be called *Magneticall*. Nay if we truely consider, these *Magneticall* *affectiones* *primarily* agree to the *Earth*, as the *mother* of all *Magneticall* *bodies*; but afterward *secondarily* are deriuē into the *parts*; because (as *Gilbert* relates it) the cause of *magneticall* *motions* and *affectiones* is the *magneticall* *forme* of a *Sphericall* *Globe*; which forme first agrees to the whole *Globe* of the *Earth*, and so is deriuē to all his *homogeneall* *parts*. These *parts* are called *Homogenall*, not in regard of their *Matter* and *quantity*, but in respect of their *Magneticall* *nature* and *communion*, which in euery *part* is conspicuous. If any man should wonder why the *Earth* should be called *Magneticall* in regard of this *minerall*, which seemes one of the least and *scarcest* *substances* whereof it consisteth; we may many wayes answere: First, that although the *surface* of the *Earth* seemes for the most part composed of other *materials*, more convenient for the *use* of *living* *Creatures* which dwell therein: yet may infinite *rocky* *mines* of *Magnets* be couched lower toward the *center*, which strengthen and consolidate the *Earthly* *Globe*. Secondly, we must not imagine the *Magneticall* *substance* of the *Earth*, to be all one kind of *stone*, but various: for somewhere it is hard & *solide* as the true *magnet* it selfe and the *iron*, which is nothing els but a *metall* decocted out of the *Load-stone*; (for *iron Oare* differs little or nothing at all from the *Load-stone* it selfe) somewhere againe, this *substance* is more *thinne* and *fluid*; being lessē concocted as some *kinde* of *clay*, and certaine *vapours* arising out of the *Earth*, which be *magneticall*: which being brought to a harder and more *massie* *substance*, will haue the *same* *affectiones* and *motions* with the *Loadstone* it selfe. This

assertion of the Earth's magneticall nature, we shall confirme more evidently hereafter, where we shall proue both the *Poles*, the *Meridians*, *Parallels*, and other circles, to be not bare *Imaginari* lines, as some haue thought (but to be *Really* grounded in the magneticall nature of the Earth, and are to be shewed in any round Loadstone, wrought and placed conveniently with instruments thereunto applyed.

- 2 The Magneticall affection of the Earth is twofold, either *Radicall* or *Deriuued*. The Radicall disposition we call that which is the first root and ground of all other magneticall motions.
- 3 The Radicall vertue or inclination is again twofold, either *Motiuue* or *Disponent*. The Motiuue is that by which all magneticall bodies are inclined and stirred vp to the motion.

In the *Reasonable soule* of a man, wee haue two faculties which shew themselues; a *motiuue*, and a *directive* or *disponent* power: whereof the one stirres vp the motion, the other regulates, conformes, and directes it: The former is the *Will*, the later the *Discourse* and *Judgment*. This distinction of faculties, howsoever more evident in the soule, findes place in all *Naturall* agents: in which a Philosopher ought to distinguish betwixt that which giues them a power to moue, and that which limits, determines, and (as the Schoolemen are wont to speake) *modificates* the action. Amongst others the magnet stone seemes most to partake of these two powers, as that which amongst all naturall agents (in *Gilberts* opinion) seemes most to haue resemblance with the soule of a man: so that by an apt Trope it hath bin called of many, the Magneticall soule of the Earth; for hence we may well perceiue one vertue or inclination, which causeth the magneticall needle to moue out of its place; another

other by which it is apt to conforme it selfe North and South, as also to obserue certain angles correspondent to the latitude of the place, as shall be demonstrated in due place. Of the motiue power we will produce these Theoremes.

1 *The Magneticall motion is excited in a small and unperceiuable difference of time.*

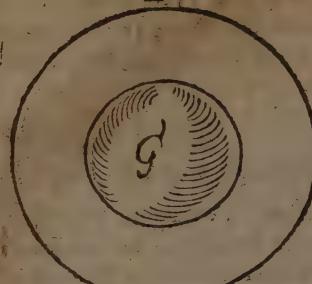
This proposition may be shewed out of euident experiment, wherein every mans sight may be a witnes. For if an *Iron needle* touched with the *Loadstone*, be placed within the *Spheare* of the *magneticall vertue* of the stone, it will presently moue it selfe, notwithstanding the interposition of solide bodies, which made *Gilbert* to imagine this motion to be effected by a meere *spirituall and immateriall efflux*, which may well be compared to the *light*, which neverthelesse it surpasseth in subtilty: for the light is moued from *East* to *West* so quickly, insomuch as many haue thought this motion to haue bin in a *moment* or *instant* of time. But this quicknes of motion may much more be imagined in the *Magneticall vertue*, being of a more subtile and piercing nature, as may be gathered from this reason, to wit; That the light is alwayes hindered by the interposition of a *thick* and *spacious* body; but the vertue *Magneticall* findes a *passage* through all solide bodies whatsoever; and meetes with no impediment.

2 *This Motiue qualitie is sphærically spread through euery part of the Magneticall body.*

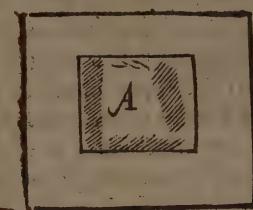
Here againe may we finde a great resemblance betwixt the *magneticall vertue* and the *light*; for as all light *Bodies*, as the *Sunne*, *Moone*, and *Starres*, cast their *beames* every way into an *orbicular forme*: so this *Magneticall vigour* casts it selfe as broad not only from the *center* toward the *superficies*, but from the *superficies* outward into the *Aire* or *Water*, where this *magneticall body* is placed, and so makes vp a *Spheare*; but yet with this difference, that if the body be meere and perfectly *Sphæricall*, the *Orbe* of the *magneticall vertue* will end in a *perfect Spheare*, as we see the *magnet G* to confine his *vertue*

C within

B



F



D

L.

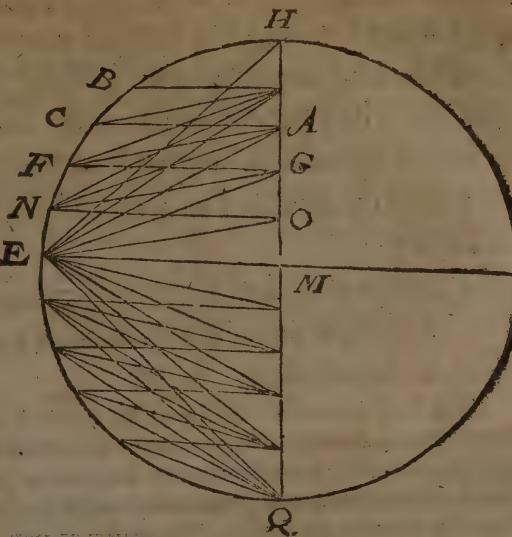
within the Circle B F. But if it be a square, or any other figure not Sphaerical, it imitates a Spheare as neare as the body will suffer, in that it spreades it selfe every-where from the center by right lines; yet will it be confined in a square figure correspondent to the body, whence it proceeds, as we see the vertue of the *square magnet A*, to cast his beames into the square figure L D.

3 The motiue quality of the Magneticall body is strongest of all in the Poles, in other parts by so much the stronger by how much these parts are situated neare the Poles.

We suppose out of the principles of Magneticall Philosophie, that a Magnet hath two *Poles*, whose vse we shall shew hereafter. These *Poles* are found by experiment to haue more force and vigour in them then other parts, and all other parts to enjoy more or lesse force, by how much nearer or farther off they are situated to their *Poles*. The reason is ascribed by these Writers to the disposition of the *Magneticall* vigour in the body of the Loadstone, as shall appeare by this figure following in *Gilbert*, expressing the great *Magneticall* Body of the earth. Let the Sphaericall *superficies* of it be H Q E, the Pole E, the Center M. H Q. the plaine of the *Æquinoctiall*; from euery point of this *Æquinoctiall* plaine, the vigour Magneticall is conveyed and extended to C F N E; and to euery point from C to E the Pole; but not towards the point B, so neither from

G

G towards C. The vigour is not strengthened in the part F H G, from that which is G M F E; but F G H doth increase the virtue in H: so that there can arise no vigor so far from the parallels to the Axel-tree aboue the



said parallels, but internally from the parallels to the Pole. So we see that from every point of the *Æquinoctiall* plaine, the force is derived to the Pole E. But the point F hath onely the vigour from G H, and the point N from O H: but the Pole E is corroborated and strengthened from the whole plaine of the *Æquinoctiall* H Q. Wherefore the vigour magneticall in this Pole is most eminent and remardeable, but in the middle spaces; as for example in F, the magnetical quality is so far strengthened, as the portion of the *Æquinoctiall* plaine H, can giue. But Dr Ridley in his late Magneticall Treatise, in the 6 Chapt. seemes to oppose this Demonstration. For although hee acknowledgeth that the vigour is strongest of all in the Poles; yet (sith he) if tryall bee made what the Pole will take perpendicularly; and also what the parts aboue 34 degrees will lift vp, it will appeare to be halfe as much perpendicularly; so that the Pole doth not take vp as much, as this and the other part doth on the other side. But the decision of these differences I leau to such as are more experimentall then my selfe, being

destitute of those helpe and instruments which they enjoy.

4 It behoues vs in the second place to speake of the Disponent vigour of Magnetical bodies. The Disponent force we call, that facultie by which magneticall Bodies are disposed or directed to a certaine site or position.

I *Magneticall bodies moue not uncertainly, but haue their motions directed and conformed to certaine bounds.*

This Proposition is confirmed by manifold experiments. For magnetical bodies are neuer found to moue vncertainly, & at all adventures, but conforme themselues to certaine Polcs; and make certaine angles *proportionall to the latitude*, as we shal shew hereafter in particular. The reason of which experiment we can draw from no other cause, then the first institution of Nature in all Naturall agents, which she would haue directed to certaine ends, that nothing in her Common-wealth might seeme idle or vnecessary; wherefore she gives all agents not only a *power* to worke their ends; but also shewes them the *way*, squares and regulates the meanes which direct vnto the end. No-where is this *directive* power more remarkable, then in magnetical bodies, especially in their *Direction* and *Variation*, motions treated of hereafter in place convenient; to which for a further confirmation of the Theoreme, wee referre the Reader.

9 The Radicall facultie of the magneticall body being somewhat spoken of, aswell in their motiue, as disponent vertues. We are in the next place to speake of the deriuued motions, which arise out of these faculties.

6 These

6. These motions magneticall are either *partiall*, or *totall*. The partiall we call that by which the parts of the Earth are magnetically moued and conformed as well one to the other, as to the whole terrestriall globe.
7. The magneticall partiall motions are *Coition, Direction, Variation, and Declination*. Magneticall Coition is that motion by which magneticall bodies are ioyned and apply themselfes one to the other.

For the knowledge of this magneticall motion, we need goe no farther then the *Iron* and *Steele*, which we shall obserue to moue vnto the Loadstone, and cleave vnto it, if so be it be placed within the Spheare of his vertue. This motion is commonly called *Attraction*, but improperly, as is obserued by D. *Gilbert*.¹ Because *Attraction* seemes to suppose an externall force or violence, by which one thing is carried and moued vnto another: but the *Coition* is merely naturall, as proceeding from the internall forme of both the bodies.² Attraction supposeth the force of moving to be onely in the one party, and the other to be merely passiu, and not actiuely concurring to this motion; whereas in the magneticall coition, both parts are mutually inclined by nature to meet and ioyne themselfes one to the other. Not that the force of motion in both parts is alwayes equall: because one magneticall body is greater and stronger then the other, and then the one part seemes to stand still and draw the other vnto it, although there be in this part so resting an inclination to the other; which mutuall inclination of conjunction in magnets, we may easily see in two magnes of equal quantity and vertue, which being set at a convenient distance, will so moue, that they will meet in the mid way. Some haue gone about to parallel this *Attractive* force of the Loadstone with the *Attractive* force of *Leat* or *Amber*, which we see by a

naturall vertue to draw vnto it selfe little strawes, and other such like matter. But he that truely vnderstands the nature of a magneticall body, shall finde a great disparity: First, because the leat or Amber which are comprised vnder the name of *Electricall* bodies, drawes vnto it by reason of his *Matter*: where-
as otherwise the cause of the *Magneticall Coition* is to bee sought in the *forme*, as being too subtile a thing to spring from a materiall substance. Secondly, *Electricall* bodies draw and at-
tract not without rubbing and stirring vp of the matter first; & presently faile, if any vapour or thick body should be interpo-
sed. But in a magneticall motion we find no such matter, be-
cause it requires no such preparation or rubbing of the stone, nor is hindred by interposition of solid bodies, as we proue in this place. Thirdly, the Loadstone moues and prouokes to motion nothing els but other magneticall bodies; but the *Electricall* will draw any litle thing, as straw, haire, dust, and such like. Fourthly, the Magnet will lift a great waight according to his vertue and quantity; but leat the smalles and lightest things. Lastly, the *Electricall* bodies, as *Gilbert* well confirmes by ex-
periments, draw other bodies vnto them by reason of a *meist* effluence of vapours, which hath a quality of ioyning bodies together: as we see by the example of two stickes in water at a certaine distance, which will commonly moue till they meet to-
gether. But the *magneticall coition* cannot be other then an act of the magneticall forme. Of the cause of it many Philosophers haue freely spent their vncertaine conjectures, rather out of a feare to be esteemed ignorant, then of confidence to be accounted learned. Most run vpon the forme of the mixt body, which growes from the composition of the foure Elements; but this opinion is very feeble, and cannot goe without crouches: for sith all mixt formes grow out of the temperament and disposi-
tion; they adde nothing to the thing compounded, but diuersly modificate what was before in the simple Elements; it cannot bee imagined how such an affection as this should bee onely found in the magnet, & no other mixt body. Indeed we ascribe this affection to the *forme* as the immediate cause; but by this *forme* we understand not the forme of the *mixture*, resulting out

of the mixture and temperature of the four qualities; but the magnetical forme of all globous bodies, such as are the *Sunne, Moone, Starres*, and this *Trrrestriall Spheare* whereon we liue, whose natures received the stampe in the first creation for the preseruation of this integrity. He that shall seeke for the originall of all *formes* of this kinde in the *mixture and constitution* of the feure Elements, shall labour much, and finde little, and neither at laft be able to content himselfe, or instruct others; except we suppose a man sufficiently taught when he heares ordinary matters expressed in *exotiske* and *artificiall* termes. For my owne part, I content my self with a rule of *Biel the Schoolman*; That when an immediate effect proceedes from an immediate cause, we ought not to search farther why such a cause should produce such an effect. Every man being demaunded why the *fire is hot*, is ready to flye to the *forme of fire*, and alleage this as the cause: but should he inquire further, why the forme of fire should be the cause of heat, he might perhappes puzzell a whole Academie of Philosophers, and neuer proue himselfe the wiser. For the further illustration of this motion, these Theoremes will seeme necessary.

I *The Magnet communicates his vertue to iron or steele if it be touched with it.*

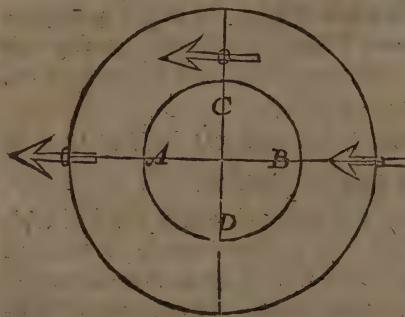
Experience teacheth that any iron instrument, touched with the Loadstone, receiuers instantly the same vertue *Attralline*. But the manner how this vertue should be communicated on so sleight a touch, hath bin controuerted. The common Philosophers haue imagined, that certain little parts of the Loadstone are separated from it in the touch, which cleaving to the iron or steele, cause this Attraction. But that this vertue cannot be communicated by any *corporall processe*, or any such little parts cleaving to the iron, is not so easie to imagine: for first it seemes impossible, that with a bare touch, these parts should be separated from the magnet, or at least should bee so fast linked to the iron. Secondly, these parts being so litle and insensible, cannot haue so much yigour as wee see an Iron will haue at the touch of the Loadstone. Thirdly, the Loadstone can worke vpon the

the iron notwithstanding any body interposed, which is an evident signe that the iron it selfe is of a magneticall temper. Wherefore to shew a reason of this effect, we say; That Iron is a metall excocted out of the Loadstone; which albeit it retaine in it selfe the vertue of the Loadstone, yet by reason of the liquefaction, is altogether languishing, and as it were buried; but vpon touch of a Loadstone, is stirred vp to his former vigour: for the magnet insinuats his *Incorporeall* influence into the iron, and so rectifies and animates that force which was almost dead.

2 The magneticall Coition is strongest of all in the Poles.

This may easily be demonstrated by an experiment: for if the iron needle which is proposed to bee *Attracted*, and the *Poles* and *Center* be placed in the same right line; then this *Coition* will be to a perpendicular, as in A and B, to wit, the *Poles* in the Diagramme: but in the middle space they will obliquely respect and point: and by how much farther off from the *Pole* it is, by so much is this vertue weaker: but in the *Æquator* it selfe it becomes merely *parallel* without any inclination at all.

To know in what proportion this force is increased or weakned, we must put another ground; That the force of this coition is increased proportionally as the chords of a circle: for by how much the least chorde in a circle differs from the *Diameter*, so much the forces *Attractiue* differ from themselues. For sith the *Attraction* is a Coition of one body with another, and magneticall bodies are carried by a *convertible* nature it comes to passe that a line drawne from one *Pole* to another in the diameter, direct-



sy meetes with the body, but in other places lesse, so that the lesse it is converted to the body, the lesse and weaker will be the coition.

8 So much be spoken of the magneticall *Coition*: It followes that we speake of Magneticall *Direction*, which is a naturall conversion & conformity of the magneticall bodies to the Poles of the Earth.

It is manifest that a magneticall body so seated, that it can moue without any impediment, will turne it selfe in such wise, that the one Pole of it will respect the *North* Pole of the Earth, the other the *South*, which motion we call *Direction*. This wee may plainly see in a Martiners compasse, whose *Lilly* alwayes respects the *North* point. If a compasse be wanting, the same may be shewed in a little *carken-boate*, which being put in the water with a *load-stone* in it, will so turne and convert it selfe, that the Poles of the *Load-stone* will at length point out the Poles of the *Terrestriall Globe*. The manner how, shall be disclosed in these Theoremes.

I *The South part of the Load-stone turnes to the North, and the North part to the South.*

To confirme this assertion, some haue produced this experiment. Let there bee cut out of a rock of *Load-stone*, a *Magnet* of reasonable quantity. Let the two Poles both *North* and *South* be marked out in the *Load-stone*, the manner of which, we shall perhaps teach hereafter: then let it be put in a carken little boat on the water, so that it may freely float hither & thither: It will be euident that that part which in the rock or Mine pointed *Northward*, will respect the *South*, and contrary wise the *South* part will respect the *North*; as we may see in this figure: Let the *Magnet* as it is continuated with the Mine or *Globe* of the Earth be *A B*, so that *A* shall be in the *North*.

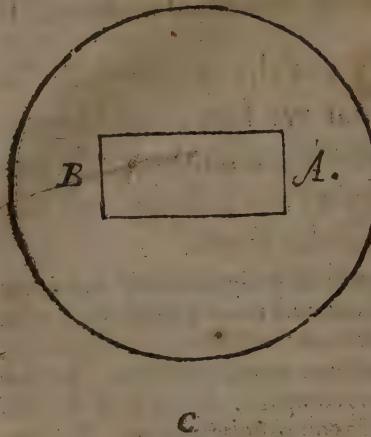
H



B

pole

D



C

Globe of the Earth. The reason why the magnet in the boat on the water, turneth, windeth, and seateth it selfe to a contrary motion to that it primarily received, whiles it was ioyned to the bowels of the Earth, and vntied to the body of the great Magnet, is; because every part of a Load-stone being separated from the whole, whereof it is a part, becomes of it selfe a perfect, compleat, magneticall body, (as we may say) a *little Earth*, hauing all the properties of the great Globe, as *Poles*, *Meridi-ans*, *Eqnators*, &c. And therefore according to the nature of magnetical vniion, spoken of in our next Theoreme, will in no wise endure to settle it selfe as it did before; but deemes it a thing more naturall, and of more perfection, to turne his aspe&t a contrary way, to that which he inioyed at his first constitution. Here may we note a great errorre of *Gemma Frisius*, who in his corollary vpon the 15 Chap. of his *Cosmographicall Comment on P. Appian*, affirmes; that the Needle magnetically affected, would on this side the *Eqnator*, respect the *North-pole*; but being past the Line, would straightway turne about, and point to the *Southpole*: An errorre (as Mr *Haes* saith) vneworthy so great a Mathematician. But *Gemma Frisius* in some sort,

pole, B the *South Pole*. Let this Load-stone be cut out of this rocke or Mine, and placed on the water in a little timber boat, which shall be C D: we shall find that this little dish or boat will turns it selfe so long, vntill the *Northpart* A, be turned to the *Southpart* B: and on the other part, the *Southpart* B, be converted to the *Northpart* A: and this conformity would the whole rock of Load-stone claime, if it were diuided and separated from the

sort, may be excused; forasmuch as the grounds of magneticall Philosophy, were in his time either not discouered, or most vnperfectly knowne, and the vncertaine relations of Navigators were reputed the best Arguments: and how easie a matter it is for a Trauailer in this sort to deceiue a Scholler, who out of his reading and experience can shew nothing to the contrary, let every man judge.

2 *This contrary motion here spoken of, is the iust confluxe and conformity of such bodies to magneticall vniōn.*

This is demonstrated by *Gilbert* in this manner. Let the whole magneticall body be C D, then C will turne to the North of the Earth B, and D vnto the South part A. Let this magnet be cut

in twaine by B C E F D A
 the middle line

or *Æquator*,
 and the point
 E will tend to
 A, and the part
 F, will direct it

B F D C E A

selſe to B: for as in the whole, ſo in the parts diuided, nature desires the vniōn of theſe bodies. The end E willingly accords with F; but E will not willingly ioyne it ſelſe with D, nor F with C, for then it would haue C, againſt its nature, to moue toward A the South, or D in B, which is the South. Separate the ſtone in the place of diuision, and turne C to D, and they will conveniently agree and accord; for D will turne it ſelſe to the South as before, and C to the North; and E and F ioynt parts in the minerall or rock, will now be moft ſundred. For theſe magneticall parts concurre and meet together not by any affinity of matter, but receive all their motion and inclination from the forme; ſo that the limits, whether ioynt or diuided, are directed magnetically to the Poles of the Earth, in the ſame manner, as in the diuided body.

3. If any part Southward of the magneticall body be torne away or diminished, so much shall bee also diminished of the North part; & contrariwise if any part be taken away in the North part, so much shall the vertue of the South part be diminished.

The reason is, because the Magnet hauing eminently in it the circles which are in the Earth, is separated or diuided by a middle line or *Æquator*, from which middle space the vertues are conveyed toward either Pole, as we haue before shewed. Now any part being taken away from the North or South part, this *Æquator* or middle line is remoued from his former place into the midst of the portion which is left, and so consequently both parts are lesse then before: For although these two ends seeme opposite, yet is one comforted and increased by the other.

9. Of the motions of Coition and Direction we haue handled. It followes that we speake of the motions of the second order, to wit, *Variation*, and *Declination*.

10. Variation is the deviation or turning aside of the directory Magneticall needle from the true point of North, or the true Meridian towards East or West.

In the discourse immediatly going before, hauing treated of the magnetical body, we haue imagined it to be true, and pointing out the true North and South points of the Terrestriall Globe; which certainly would be so, if the substance of the Earthly Globe were in all parts and places alike, equally partaking the Magneticall vertue, as some round Loadstones; neither should we find any variation or deviation at all from the true Meridian of the Earth: But because the Terrestriall Globe

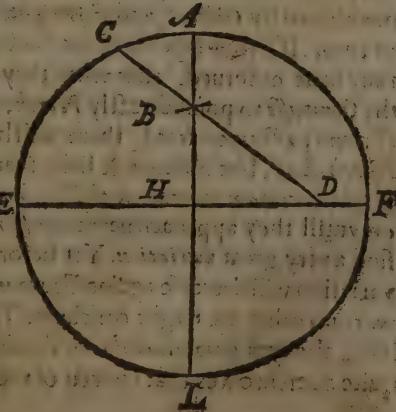
is found by Navigatours to bee vnequally mixed with many materialls, which differ from the magneticall substance, as furnished with rockie hills, or large valleyes, continents, & Ilands, some places adorned with store of iron Mines, rockes of Loadstone, some altogether naked & destitute of these implements; it must needs fall out, that the magneticall needle & compasse directed & conformed by the Magneticall nature of the Earth, cannot alwayes set themselues vpon the true Meridian, that passeth right along to the *Poles* of the Terrestriall Globe; but is forced and diuerted toward some eminent and vigorous magneticall part; whereby the *Meridian* pointed out by the magnet, must needs varie and decline from the true *Meridian* of the Earth, certaine parts or degrees in the *Horizontal* circle; which diuersion we call the *Variation* of the compasse: so that Variation, so far as it is obserued by the compasse, is defined to be an *Arch* of the *Horizon*, intercepted betwixt the common intersection with the true *Meridian*, and his *deviation*. This effect proceeding from the Inæquality of magneticall vertue scattered in the Earth, some haue ascribed to certaine Rockes, or mountaines of Loadstone, distant some degrees from the true Pole of the World; which rockes they haue termed the Pole of the Loadstone, as that whereunto the magnet should dispose and conforme it selfe: which conceite long agoe invented, was afterward enlarged and trimm'd ouer by *Fracastorius*. But this opinion is a mere conieecture, without ground: for what Navigatours could he euer produce that were eye-witnesses of this mysterie? or how can he induce any iudicious man to beleue that, which himselfe, nor any to his knowledge ever saw? The relation that the Frier of *Norvegia* makes of the Frier of *Oxford*'s discouery, recorded by *James Cnoien* in the booke of his Trauels, where he speakes of these matters, is commonly reiected as fabulous and ridiculous; for had there beeene any such matter, it is likely he would haue left some monumëts of it in the records of his owne Vniuersity, rather then to haue communicated it to a friend as farre off as *Norvegia*. Moreouer the disproportion in the degrees of variation in places of equal distance, will easily correct this error, as we shall shew in due place.

place: More vaine and friuolous are all the opinions of others concerning this magneticall variation: as that of *Cortesius*, of a certaine motiue vertue or power without the Heauen; that of *Marsilius Ficinus* of a starre in the Beare; that of *Petrus Peregrinus*, of the Pole of the world; that of *Cardan*, of the rising of a starre in the taile of the Beare; that of *Beftardus Gallus*, of the Pole of the Zodiacke; that of *Livius Sannius*, of a certaine magneticall Meridian; of *Francis Maurolycus*, of a magneticall Iland; of *Scaliger*, of the heauen and mountaines; of *Robert Norman*, of a respectiue point or place: All which Writers seeking the cause of this variation, haue found it no further off then their owne fancies. More probable by farre, and consonant to experience, shall we finde their opinion, which would haue the cause of this variatio be in the Inæquality of the magneticall Eminencies scattered in the Earth. This Inæquality may be perceiued to be twofold. 1 in that some parts of the Earth haue the magneticall minerals more then other parts; forasmuch as the *superficies* of some parts is solide Earth, as in great Continents: 2, Because although the whole Globe of the Earth is supposed to be magneticall, especially in the Internall and profound parts: yet the magneticall vertue belonging to those parts is not alwayes so vigorous and eminent as in some other parts; as we see one Loadstone to be stronger or weaker then another in vertue and power: but of those two, the former is more remardeable, which may be shewed by experiance of such as haue sailed along many sea coastes: for if a sea-journey be made from the shore of *Guinea* by *Cape Verde* by the *Canarie Islands*, the bounds of the Kingdome of *Morocco*, from thence by the confines of *Spaine*, *France*, *England*, *Belgia*, *Germany*, *Denmark*, *Norvegia*: we shall find toward the East, great and ample Continents; but contrarywise in the West a huge & vast Ocean: which is a reason that the magneticall needle will varie from the true point of the *North*; and inclines rather to the *East*; because it is more probable that these Continents and Lands should partake more of this magneticall minerall, then the parts couered with the Sea, in which these magneticall bodies may be scarcer, or at the least deeper buried, and not so forceable.

forceable. On the contrary part, if we saile by the *American* coasts, we shall rather find the *variation* to be Westward: as for example, if a voyage be made from the confines of *Terra Florida*, by *Virginia*, *Norumbega*, and so Northward, because the land butteth on the West: but in the middle spaces, neare the *Canary* Islands, the *directory* needle respects the true Poles of the Terrestriall Globe, or at least shewes very little variation. Not for the agreement of the *Magneticall* Meridian of that place with the true, by reason of the Rock of Loadstone, as some haue imagined: because in the same *Meridian* passing by *Brasile*, it falleth out farre otherwise: but rather because of the Terrestriall Continents on both sides, which almost diuide the *Magneticall* vigour, so that the *Magneticall* needle is not forced one way more then another; the manner whereof we shall finde in *D. Gilbert* expressed in an apt figure, to whom for further satisfaction I referre the Reader.

I. *The Magneticall variation bath no certaine Poles in the Terrestriall Globe.*

It is but a common received error (as we haue mentioned) that there is a certaine Rock or Pole of Loadstone, some degrees distant from the true Pole of the world, which the *Magneticall* needle in it's *variation* should respect. This Pole they haue imagined to be in the same *Meridian* with that which passeth by the *Azores*, whence they haue laboured to shew the reason why the *Compass* should not vary in that place: which they ex- plaine by this Figure. Let there be a circle de- scribing the *Sphare*, E A F, the *Horizon* E F, the *Articke Pole* A, the *Antarticke* L. The *Pole* or *Rock* of *Load- stone*



Stone placed out of the Pole of the Earth B. Let there be placed a magneticall directory needle in H ; it will (according to their assertion) tend to the point B, by the magneticall Meridian H B; which because it concurses with the true Meridian B A, or H A, there will be no variation at all, but a true direction to the North Pole of the Earth. But let this magneticall needle be placed in the point D, it is certaine, according to this opinion, that it will tend to the Pole of the loadstone B, by the magneticall Meridian D B. Wherfore it will not point out the Pole of the Earth A, but rather the point C; because these two Meridians come not into one and the selfe-same. Hence they haue laboured with more hope then successe, to find out the *longitude* of any part of the Earth, without any obseruation of the Heauens: which I confess might easilly be effected, if this conjecture might stand with true obseruation. But how farre this conceit swarues from the experiance of Navigatours, one or two instances will serue to demonstrate. For if the *variation* had any such certaine poles as they imagine, then would the *Arch of variation* be increased or diminished proportionally according to the distance of the places. As for example; If in the compasse of an hundred miles, the Compasse were varied one degree, then in the next hundred miles it would vary another degree, which would make two degrees. But this hath often bin proued otherwise by diuerte experiments of Navigations, mentioned by *Gilbert*, and *E. Wright*. I will onely produce one or two. If a ship saile from the Sorlinges to *New-found-land*, they haue obserued, that when they come so farre as to finde the Compasse to point directly *North*, without any variation at all; then passing onward, there will be a *variation* toward the *North-East*, but obscure & litle: then afterward will the *Arch of this variation* increase with like space in a greater proportion, vntill they approach neare the *Continent*, where they shall find a very great *variation*. Yet before they come ashoare, this *variation* will decrease againe. From which one instance, if there were no other, we might conclude; That the *Arch of variation* is not alwayes proportionable to the *distance*: which granted, quite ouerthrowes that conceit of the Poles of variation. Beside

line drawne from the Center E, which shall be E D. This line E D will be the true Meridian for that place, on which when the shadow of the gnomon shall happen to fall, we may assure our selues that it is full Noone.

7 The Magneticall Inuention is performed by the Magneticall Directiorie Needle.

This way is subiect to much errour, and not so certaine as the former, because (as we haue shewed before) there are found very few places which admit not of some *Variation*: yet because it may be profitable to such, who haue not the Command alwayes of the *Sunne*, or sight of the *Starres*, I will insert this *Theoreme*.

I The Line wherein the Directory needle is directed from North to South, is the Meridian for the place.

This may be shewed in any Marriners *Compasse*, or little *Sunne-Dyall*, whose needle is magnetically touched. For being set evenly parallel to the plaine of the *Horizon*, it wil shew by the needle, the Meridian for that place in euery vertical point on the earth. For example in the *Sea-Compasse* in the next page, experience will witnesse in euery Region of the Earth, that the one point signed out by the *Lilly*, will alwayes turne to the *North*; the other opposite part, will turne it selfe to the *South*; which two parts being ioyned together by a right Line will shew the Meridian for that place: The Meridian (I say) not alwayes the true; for this Inuention taken from the *Magnet* is not so exact as the Astronomicall: for as much as few or no places are found, wherein the *Magneticall* Needle admits not a *Variation* from the true points of *North* and *South*: Neuerthelesse, this way is very necessary to be known: for as much as the *Sunne* and *Starres* are not alwayes to be seene; at least in such place and manner as may fauour exactnesse of obseruation: Hence may be demonstrated in particu-



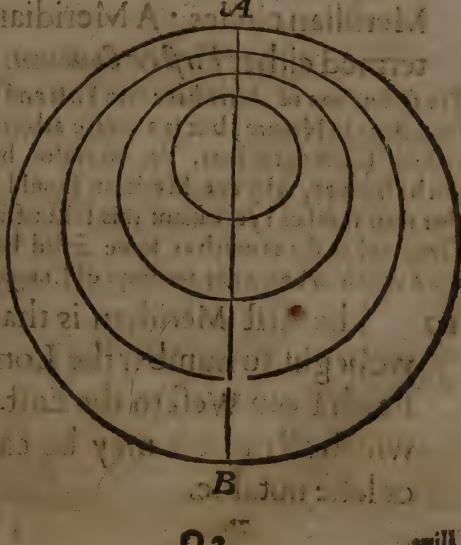
lars, what we obseruē before in generall in our *Magneticall* Treatise that the *Circles* of the *Globe* are not meere *Imaginari* *Fictions*, or bare *Resects*, growing out of the Application of *Celestiall* *bodies* (as some haue thought them) but grounded on the *Magneticall* *Disposition* of the *Terrestriall* *Globe*.

8. Beside the *Astronomicall* and *Magneticall* Invention of the Meridian, there is another way more popular, but lesse exact, which is without any obseruation of the Heauens, or the Magnets operation. Of the Invention of the Meridian circle, the true and exact knowledge,

knowledge (as we haue shewed) is enclipted to heauonly obseruation, or Magneticall experimēt. Neuerthelesse, Nature is not so barren, but she hath pointed out to an industrious obseruation, some markes and foote-steps in other inferiour bodies, for the finding out of this profitable circle. Which wayes, howsoeuer of lesse *Accour* then the other, and therfore of lesse vse, are notwithstanding pleasant to vnderstand: because nothing delights more an ingenious minde, then the contemplation of Gods working, in and by his creatures, which men vsually terme *Nature*. To make a particu'lar search into all Plants, Stones, Mettals, and other such Bodies, were to goe too farre out of my way, without a Guide. I will giue one onely Instance of Trees, whereof I will insert this Probleme.

I *By the Incision of a Tree, to finde out the Meridian.*

To performe this Probleme, let there be chosen out some Tree, in an open free field, farre from walles or other obstacles; in such a place as it hath beeene on either side freely enlightened and heated by the Sunne-beams: let the Trunk of this Tree bee very right and sound: let this Trunk be cut off by the middest, in such sort that the section bee Parallel to the Horizon, and the ynder-part of the Trunk bee left to stand in his former Naturall situation: Now the Section on the top of it being well plained,



will as in a plaine discouer diuers circles, which are *Excentricke* and not drawne from the same Center, but on the one side neerer together; on the other further off: That part then which shewes the circles thicker and neerer together, points out the North: The other wherein the circles are wider and further off, the one from the other, designes out the South-point: betwixt both which if a right line be drawne, it will be the *Meridian* for that place. Which experiment *Blancanus* (as hee writes) tryed in a *Plume-Tree*, but giues no reason for it. The cause I take to be no other then the extension and diffusion of the sappe or moisture, by the heate of the Sunne: which is more on the *South-side* then the *North-side*: for as much, as the *Sunne* in our clime respects vs on the South, neuer on the North. Hence is it, that the circles which are nothing else but the excrescences of the moisture, being more rarefied on the *South-side*, and therefore requiring a greater place, are found to be greater.

9 Hauing shewed the *Invention*, we are in the next place to treat of the *Distinction* of these *Meridian* circles: A *Meridian* therefore is termed either *First* or *Common*.

The distinction of *Meridians* into *First* and *Common*, hath no foot-steps in Nature, but is a meere arbitrary Imposition of antient *Cosmographers*. For no reason besides *Conueniency* can be shewen, why one *Meridian* should be called *First* rather then another: yet cannot this *Distinction* be wanting to a *Geographer*, for as much as some settled bound must be set, from which to begin our accompt of *Longitudes*.

10 The first *Meridian* is that from which we begin to number the *Longitude* of the Earth, from *West* to the *East*. In respect of which all the rest may be called *common* or *lesse notable*.

The ancient Cosmographers, amongst whom *Ptolomy* wa,
the chiefe, haue set the first Meridian in the *Fortunate Islands*,
from whence they began their accompt, passing Eastward
through *Europe* and *Africa*, and so through *Asia*, to the vther-
most parts of *India*, vntill they returned againe to the first Me-
ridian, passing through the *Fortunate Islands*; Some haue
doubted whether these Islands called by *Ptolomy* the *Fortunate Islands*,
be the same with the *Canaries*; because (as our Countrey
man M^r. *Hues* hath obserued) the Latitude giuen by *Pto-
lomy* to the *Fortunate Islands*, agrees not exactly to the *Canaries*;
but rather to the Islands of *Cape-Verde*. Notwithstanding this
obseruation, I rather sticke to the common opinion, thinking
it no vnlike matter, that *Ptolomy* dwelling farre Eastward, and
trusting to othermens obseruations, should erre in this, as well
as other maters. The reason why the first Meridian should be-
placed here, rather then elsewhere, is thought by some to be; be-
cause the Ancient's supposed two *Magneticall Poles* in the
Earth, which should be the cause of the *Variation* of the *Com-
pass*. Now because in the *Canary Islands*, was found no *Vari-
ation* at all, they thought it to be the place where the *Magne-
ticall* and the *true Meridian* should concurre, as wherein were
both the *Poles*, of the *World*, and of the *Load-stone*: which made
them to make it the first Meridian: But this reason I take to
be vnlikely; because as I finde it obserued by latter Writers, in
the *Canary Islands* themselves there is found a *Variation* of
the *Compass*, although very little: the reason whereof wee
haue shewed to be because it is the middest betwixt two great
Continents, to wit, the one of *Europe* and *Africa*, the other of
America. Whose magneticall temper being almost *æquall*,
will not suffer the magneticall *Needle* to moue more one way
then another? Moreouer, I am certainlye perswaded (as farre
as I can gather) that this placing of the *First Meridian* was
appointed here before any certaintye was knowne of the *Vari-
ation* of the *Compass*. The more probable conjecture there-
fore is that *Ptolomy* here placed the *First Meridian*, because it
was the vthermost verge of land toward the *West*, then
discouered, neuer dreaming of a *Western* world afterward

detected and brought to light by Christopher Columbus and Americus Vesputius. Some of the latter Geographers striuing to be more exact, haue placed the *First Meridian* in their Mappes out of the *Canaries* in the Islands of the *Azores* called *S. Michaels Iland*. So that the first Meridian of *Ptolomy* differs from the place of these latter *Cosmographers* about 9 degrees: which is diligently to be noted of such as beginne the Science; because this variety not perceiued, will breed great error and confusion: yet is not the first of *Ptolomy* out of vse, but retained of many good *Geographers*. Every other *Meridian* in respect of this, may be called *Common*, or lesse notable, because this is most remarkable: yet may the rest compared amongst themselues be ranged in a certainte order, as the *Second, Third, Fourth, Fifth*, and so along till we come againe to the *First*, being in all reduced to the number of 180, answering to 360 Degrees as we haue taught. So much for the *Meridians*.

II. The Parallels are æquidistant Circles passing from the East to the West directly.

I haue defined the *Parallel* Circles in a larger sense then former *Geographers* vsually haue taken it in: as willing vnder this general name, not onely to include the *Parallels* commonly so called, bnt also the *Æquator*: because I see no reason why the *Æquator* being esywhere æquidistant from each other Circle, should not suffer this acceptation. The common sort of *Cosmographers*, vnder this name, would onely comprise the minor Circles, which are conceiued to be æqually distant and correspondent to the *Equinoctiall Circle*, so that all should be so called in respect of the *Æquator*, to whom they are said to answere, not in *site* and *position*; for as much as they decline from the middle of the Earth to the North and South: but in *Comparison* and *Proportion*; for as the *Æquator* is drawne from East to West, and diuides the whole Spheare of the Earth into the North and South Hemispheres: So the other also diuide the *Globe* of the Earth, though not into two *equal* parts as the *Æquator*, but *ynequal*. These

Parallels

Parallels many wayes are distinguished from the Meridians: first, because the Meridians are drawne directly from North to South: but the Parallels from East to West. Secondly, the Meridians, how many soever they are imagined to be, concurre and meeet all in the Poles of the Earth: whereas the Parallels howsoever drawne out at length, will never concurre or meeet in any point. Whence it must needs follow that all Parallels and Meridians in the Globe must cut one the other, and make right angles. These Paralels although infinite in number, may be in the Spheare reduced to the number of the Meridians, because they are drawne through the opposite points and degrees of the Meridian Semi-circle, which would make vp the number of 180: but yet for Conueniency they haue not painted so many in the face of the Artificiall Spheare; for as much as so many lines and circles might beget Confusion. Wherefore Ptolomy and the Ancients haue distinguished the Parallels on both sides the Aequator, North and South, with such a Distance, that where the day should increase one quarter of an hour, a new Parallell should be placed. So that the longest day of one Paralell should surpasre the longest day of another, for one quarter of an hour. By which appeares that the Parallels are not of one greatnesse, but by how much nearer the Pole they are placed, so much lesse are they; and so much greater by how much farther off from the Poles, and nearest the Aequator. These Circles are of great vse in Geographicie, as to distinguish the Zone, Climats, and Latitudes of Regions, to shew the Elevation of the Pole, and to designe out the length and shortnesse of the day in any part of the Earth.

12. A Parallell Circle is of two sorts; either greater or lesser: The greater is the AEquator or a quinoctiall Circle.

13. The AEquator is the greatest of the Parallels, passing through the middest of the Earth, and exactly diuiding them from the Poles.

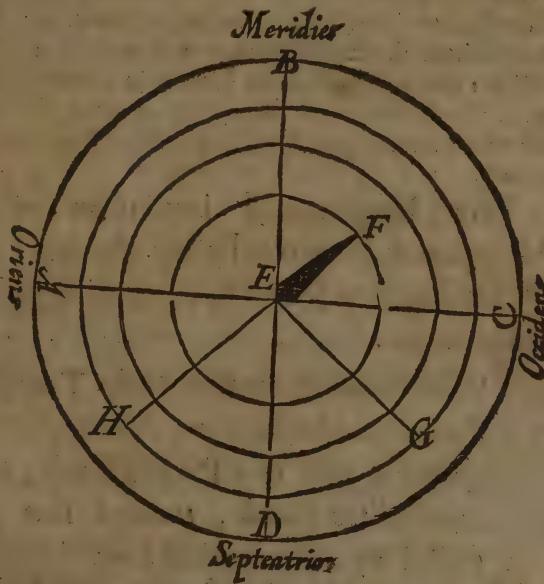
Poles into two equall halfs or Hemispheres
whereof the one is North, the other South.

This Circle is called the *Aequator* or *Equinoctiall* of *Astronomers*; because, that when the Sunne passeth vnder it, as vpon the 11 of *March*, and the 13 of *September*, it makes the Day and Night æquall. This Circle of *Astronomers* is esteemed the most notable, being the measure of the *Diurnall* and most regular Motions. The *Latines* haue taken the name and appellation of this Circle from the Day, as the *Greekes* from the Night: Wherein the Sense is no way varied; because the æquality of the Day argues the like æquality of the Night. The two Poles of the Circle, are the same with the Poles of the *Uniuersall Earth*: to wit, the *Articke* or *North-Pole*, and the *Antarticke* and *Southerne Pole*: whereof the former is alwayes conspicuous in our *Horizon*, the other lies couched and hidde from our Sight. It is called the *Articke-Pole* from the *Constellation* of the little *Beare* in the *Heauens*, neere to the which it is situated: in opposition to the which the other is called *Antarticke*. It hath manifold use in *Astronomy*, copiously described by *Astronomers*: And no lesse in *Geographie*: for without this *Equinoctiall Circle*, no Description of the Earth can be absolute and perfect, neither any *Citie* or *Place* in the *Terrestriall Globe* or *Mappe* set in his due and proper place. This *Equinoctiall Circle* in regard of the Earth, passeth through the middle-most part almost of *Africa*, by *Ethiopia*, *America*, and *Taprobana*: So that it exactly diuideth the *Globe* of the Earth into two halves, the *Northerne* and *Southerne* Hemispheres; so that these people which dwell vnder the *Aequator* are said to inhabite the middle of the world, because they incline neither to the North, nor to the South: hauing so muche distance from the *Articke* as from the *Antarticke-Pole* of the Earth. Moreover, by this Circle (as we will declare hereafter) are noted, out vnto vs the East and West part of the *Sphære*, no way to be neglected of *Geographers*.

Con-

Concerning the AEquatour, two things are to be obserued: either the *Inuention*, or the Site and Position: The Inuention is either *Astronomicall* or *Magneticall*. The Astronomicall according to these Rules.

I. The Meridian being found out, to find the AEquator.



This is easily performed by the helpe of the former Figures: for therein the Meridian line being found out (as wee haue shewed) let there be drawne by the Center E of that Circle, the line A C, making right Angles with the said Meridian: which line A C will be the true AEquatour, and will point out vnto vs the true East and West: as A the East and C the West. Whence it appeares that the two lines, to wit, of the AEqua-

tour and the Meridian doe diuide and cut the whole Horizon into two æquall Quadrants.

2 *VVithout the helpe of the Meridian to finde out the AEquatour.*

In the time of either Equinoctiall in some Horizontall plaine, in the open Sun-shine, let there be erected a Gnomon: then in the day time, let there be noted all the points by which the end or top of the shadow hath passed: for all those points in the time of Equinoctiall, are in a right line; because then the end of the shadow is carried in a line in the time of the Equinox in a Horizontall plaine: This line will be the true *Aequinoctiall-line*: the cause is giuen by *Clavius* in *Gnomonicis*. lib. 1. prop. 1. Corollar. 2. which depending on many Geometricall and Astronomicall principles, as too farre from my purpose, I omit.

15 The Magneticall inuention of the AEquatour, is wrought by the Magneticall Inclinatorie Needle, according to this Proposition.

1 *Wheresoeuer at any place of the Terrestriall Spheare, the Inclinatorie Needle shall conforme it selfe in a Parallel-wise, to the Axell of the Earth, through that place passeth the AEquinoctiall Line.*

As to finde out the *Meridian* of any place, we are to vse the helpe of the *Directory Needle*: so to the finding out of the AEquatour, and Parallels, the Inclinatorie Needle is most necessary: because the former respects the Magneticall Motion of *Direction*, the latter of *Declination*: Now wheresoeuer wee shal see the Needle to conforme it self in such sort as it may lie Parallel with the *Axell* of the Earth, we may assure our selues that such a place is vnder the *AEquinoctiall Circle*: The reason whereof

whereof wee haue giuen in our 3 Chapter, out of the *Conuer-*
table Nature of the Mag-
 net, and here needs no re-
 petition: on-
 ly wee will inserth this one
 figure wher-
 in the line C
 D drawne
 through the
 Centers of
 two Inclina-



to the Axell of the Earth, A.B. will
 expresse this *Æquinoctiall* line which we heere seek. For the
 Magneticall *Inclinator* Needle being set in a Frame or Ring
 made for such a purpose, will vnder the *Æquator* respect one
 Pole no more then another: but lie leuell with the Plaine of
 the Horizon: as vnder the Poles it will make right Angles
 with the Plaine of the Horizon. In the middle spaces betwixt
 the *Æquator* and the Poles, it will conforme it selfe in such
 sort, as it makes certaine Angles with the Axell of the Earth,
 though not æquall, yet proportionall to the Latitude; out of
 which an ingenious Artificer may deduce the Parallels of any
 place, without any obseruations of the Heauens: as is taught
 by Instruments inuented by *Gilbert, Ridley*, and diuers others
 which haue vndertaken this subiect.

16 Of the *Invention* of the *Æquator* wee
 haue spoken: In the site we ought to con-

sider the placing of the AEquatour in respect of the world.

1. The AEquatour is an vnmoueable Circle, whose Poles neuer vary from the fixt Poles of the world.

Whether the Poles of the AEquator haue bin any times varied from the Poles of the world, is a controversie which hath exercised the greatest wits: *Ioseph Scaliger* trusting (as it seemes) more to ancient History then Moderne experiment, seemes in two Epistles not only to make a doubt, whether the Poles of the AEquatour haue continued the same with the Poles of the world; but superciliously (as the manner of most criticks is) rather out of conjecture then Reason, to taxe the common opinion of manifest error and absurdity. The ground and originall of this doubt growes out of the obseruation of the fixt Starres, which haue since the Times of the Ancients, bin found to be moued out of their places, or at least not to retain the same points in the Periode of the Sunnes Motion. The chiefeſt Instances are taken from the starres in the Hornes of *Aries*, which in *Hyparchus* time, which liued aboue 60 yeares before *Ptolomy*, were obſerued to be not much diſtant from the Aequinoxe, and before him in the very point it ſelſe; but in our time remoued about 28 Degrees off: Also it is obſerued in the Cynosure or Polar starre, that in *Hyparchus* time it was diſtant from the Pole about 12 Degrees, which we finde in our time to be scarce 3 Degrees diſtant. To ſalve this Apparence, *Ptolomy* invented a ſlow motion of the Starry Heauen or Firmament, whereby the Fixt starres might bee remoued farther off from the Aequinoctiall points in the Eclipticke, whence of a conſequence the Pole-starre ſhould not keep the ſame poſition in reſpect of the Pole it ſelſe, but vary his ſite according to the Motion: which opinion hath a long time paſſed without contradiction; till *Copernicus* out of new grounds ſought for this Motion in the Earth, to which he assigned no leſſe then three Motions. Since *Copernicus*, arose *Ioseph Scaliger*, who con-

contradiciting the common received grounds, and yet for ought I see, not trusting to the suppositions of *Copernicus*, would bring in another opinion: to wit, that the Starres of the Firmament are not moued from the point of the *Aquinoco*, but rather that the point is carried away from the starres. The decision of this point I dare not vndertake, better becomming the learned and industrieous endeauours of our worthy Professours, M. Doctour Bainbrigge, and M. Henry Briggs, as best suiting with their Learning and Profession: *Ipse semipaganus, ad sacra vatum carmen offero nostrum.* Neuerthelesse as a Learner, for mine owne satisfaction, I would willingly enter a little into conference with this great and admired Oracle *Ioseph Scaliger*, to found the certainty of his grounds. That the *Pole-starre* (faulke) was so farre distant from the *Pole* as 12 Degrees, was no true obseruation, but the error of *Hyparchus*, who afterwards by his authority deceived *Ptolomy*; and He, Posterity. The Reasons he alleaged are, 1 Because *Eudoxus* which was more ancient then *Hyparchus*, obserued the same starre to be in no other place, then where now it is. 2 Because that greater light of Astronomy, *Copernicus* perceiving the *Equinoxes* and *Solstitiall* points to bee moued, was enforced to invent other grounds: but because his demonstrations depended only on the *Apparances*, he sought out this effect in the motion of the Earth. If it were manners to oppose so great a Scholler as *Ioseph Scaliger*, I would aske a few questions, why we should not credite the obseruations of *Hyparchus*, *Ptolomy*, and all posterity, as well as of *Eudoxus*: sith Antiquity without consent and approbation, is no great argument of truth. Neuerthelesse if the matter bee well examined, we shall perhappes find Antiquity to be more firme on our side. The same reason (as I take it) may be given for the starres in the Hornes of *Aries*, as of the *Pole-starre*, because all the *fixt-starres*, by the consent of all, are imagined to keep the same uniforme site among themselues in such sort, as the varving of some woul'd disorder all the rest: at least argue the like variety or change of all. Now to proue the starres of *Aries* to haue bin varied, many of the Ancients (as Master *Hues* hath obserued) living in diuers times, haue confirmed.

The first starre of *Aries*, which in the time of *Meto Atticus*, was obserued in the *Vernal Intersection*, in the time of *Thales Milesius* was before it 2 Degrees; in *Tymocharis* age it was after it 2 Degrees 24 Minutes: In *Hipparchus* time 4 Degrees, 40 Minutes; in *Abbumazars* 17 Degrees, 50 Minutes; in *Albarrens* 18 Degrees, 10 Minutes; in *Arzachels* 19 Deg. 37 Min. in *Alphonsus* his time 23 Deg. 48 Min. In the time of *Copernicus*, and *Rheticus*, 27 Degrees, 21. Min. In our time about 28. Against al these Testimonies, if we shoule oppose the Testimony of *Eudoxus* and *Scaliger*, we shoule be thought very parti-
all to preferre them before the consent of Antiquity: *Eudoxus* though very *Antient*, being but one, and the other one of the last. If any shoule object, that *Eudoxus* spake onely of the *Pole-starre*, and not of the starres in the horns of *Aries*; I an-
swere, (as before) that the same reason is to be giuen of them both; For as much, as if the *Pole-starre* in *Eudoxus* time moued in a Parallell, *Æquidistant* from the *Pole* of the *Æquatour* (which he seems to contend) then must also the stars of *Aries*, which were found once to be in the point of the vernal *Equinoxe*, moue alwayes in the *Æquinoctiall* circle, and never vary from it; which is contrary to all the Testimonies before alleadged. Secondly, where he saith, that *Copernicus* perciuing this error, left a bare discouery, without any *Demonstration*, ex-
cept onely *Ex rur quamvis*, I would know how *Joseph Scaliger* by any other meanes came to know it? I alwayes sup-
posed it a principle amongst *Mathematicians*, that the *rd quinque* had bin the surest ground of *Mathematicall Demonstration*: for every reason which can be alleadged, must of necessity be grounded on meere conieecture, as forged in a mans braine without any obseruation of Nature; or else suggested vnto vs from the things themselues. How little dependency is on the *Former*, let euery man iudge: where it is as easie for every man to deny, as affirme; and such fancies are better reserued in the braine, wherein they were first hatched, then bee suffered to proceed further. If we deriue our Argument (as we ought to doe) from the foosteppes of Nature; we must draw it either from the *Forme* it selfe, or from some *effect* or *propriety* arising from it: The former is ynpossible. I may well say in any thing,

thing; because the first forme & nature, no waies discouers it self to our vnderstanding, but by the apparent Accidents: much lesse can this be hoped for in the Heauens, being as farre distant from vs in space, as Nature. If then we are left only to the later, what other ground can we haue of our Argumentation, then the *rd p̄cip̄uera* or Apparences: which kind of way, *Scaliger* in *Copernicus* striues to sleight or reject as weake or deficient: taking then this to be the only way to search as neare as we can into the truth of their matters, we will in the third place shew how farre it may oppose *Scaliger*, and fauour our Assertion. That the first starre of *Aries* is more distant from the *Æquinoctiall* point, is a matter which seemes to be agreed on by all sides. This Apparence must necessarily arise out of some Motion. This Motion must be sought either in the *Earth* (as *Copernicus* would haue:) or it in the *heauens*. That it cannot with any great probability be in the *Earth*, we haue shewed in the third Chapter, where we haue proued it to haue a Magneticall verticity, whereby it continually respects the same *Poles*. The Arguments (I confess) are only probable: but this is an opinion which *Scaliger* defendeth not. If we seeke this effect in the *Heauens*, it must of necessity (which *Scaliger* confesseth) happen one of these 2 wayes: For either the stars standing vnmoueable, the *Æquinoctiall* & *Solstitiall* points must be moued, or els the stars theselues should moue, as *Ptol.* defends. Here I cannot but remember a merry answer of that great *Atlas* of Arts, *Sir Henry Savile* in the like question. Being once invited vnto his Table, and hauing entred into some familiar discourses concerning *Astronomicall* suppositiones: I asked him what he thought of the *Hypothesis* of *Copernicus*, who held the *Sunne* to stand fixt, and the *Earth* to be subiect to a *Triple Motion*: His answere was; he cared not which were true, so the Apparences were foloud, and the acceptt exact: fith each way either the old of *Ptolemy*, or the new of *Copernicus*, would indifferently serue an *Astronomer*: Is it not all one (saith he) sitting at *Dinner*, whether my Table be brought to me, or I goe to my Table, so I eat my meat? Such an answer would aswell befit this question: whether the first starre of *Aries* should be moued from the *Æquinoctiall*

quinociaall point, or the point from it, 'tis a matter should little trouble a Cosmographer; so either way might indifferently serue to salue the apparent obseruatiōs: But how *Scaliger* vpon this granted suppositiō, would make all whole, without disturbing the order and forme of Nature in the cœlestiall Machine? what Regular motion he would giue the Sunne, whose period describes the *Æquinoctiall points*, which he makes moueable? what other *Poles* he would assigne to the world besides that of the *Æquator*? is a matter of a more curious search, and besides the limits of my subiect: The full discussion of which points, as most of the rest: *Illiis relinquo quorum imagines lambunt-- Hedera sequaces.*

17 The *lesser* Parallels are æquidistant lines answering to the *Æquator*, which diuide the Globe of the Earth into two vnæquall parts.

18 These *lesser* Parallels are againe of two sorts: either *Named* or *Namelesse*; *Named* are such as are called by speciall names, and haue more speciall vse in Geographie; such as are the two *Tropicks*, and the two *Polar* circles.

19 The *Tropicks* are Parallells bounding the Sunnes greatest declination, which is either to the North, and is called the *Tropicke of Cancer*: or towards the South, and is called the *Tropicke of Capricorne*.

The *Tropickes* haue taken their names from the conuertion or turning back of the Sunne; because the Sunne declining frō the *Æquinoctiall* circle either North or South, proceedeth in his course no further then this circle, and so turneth backe: so

that

that in the heauens they are as limits and boundes, comprehending within them that space, without the which the Sunne never moues: Consonant to these *Cœlestiall Tropicks*, are there imagined in the earth the like, immediately placed vnder them; which are apparent, not onely by *Application* of the *Cœlestiall Globe*, and his parts to the *Terrestriall*; but also out of the *Magneticall* disposition of the earth, as we haue already shewed: The Tropicke bounding the Suns greatest declination towards the North, is called the Tropicke of *Cancer*; because the Sunne arriuing at the Tropicke, is lodged in the signe of *Cancer*: The other is termed the Tropicke of *Capricorne*; because the Sunne touching that Tropicke, is in that signe: The distance of these Tropickes, from the *Æquatour*, is ordinarily put 23. Degrees, and 30 Minutes; which is also the distance of the Poles of the *Eclipticke*, from the Poles of the world. The Tropicke of *Cancer*, as it is conceuied in the Earth; passeth by the greater *Asia*, by the *Red-Sea*, or *Sinus Arabicus*, and *China*, and *India*: But the Tropicke of *Capricorne*, situate on the Southerne side, runneth along by the most Southerne coast of *Africke*, and that part of *America* which is called *Braflia*; Besides many Ilands in the *Indian Sea*.

20 The Polar circles are Parallels answering to the Polar circles of the Heauens, drawne by the Poles of the Eclipticke: These are of two sorts; either the *Articke* compassing round the North Pole; or the *Antaricke* compassing round the *Antaricke* or South Pole.

The Polar Circles, as they are conceuied in the heauens by Astronomers, are described by the Poles of the Eclipticke, carried by the diurnall motion about the Poles of the world. Correspondent to these circles in the heauens are imagined two circles on the earth, which we also call Polar; and it wee

believe

believe *Gilbert* ; with other Magneticall Philosophers ; they are primarily in the Earth, as that which is the true subiect of diurnall motion. These circles thus described by the Pole of the Eclipticke, must needs challenge the same distance from the Pole, which the Pole of the Eclipticke hath, to wit, 23 Degrees, and 36 Minutes. The *Greekes* haue taken the Polar circles, ~~in~~ another sense then the *Latines* : for by these Polar circles (as it appeares by *Proclus*, and *Cleomedes*) they vnderstand not such circles as are described by the Pole of the *Zodiacke* ; but two other circles ; whereof the one is greatest of all the Parallels, which alwayes appeares aboue our Horizon ; the other is the greatest of all those Parallels which lie hid in our Horizon perpetually : The reason why the *Gracians* tooke it in this sense, was ; because by these circles they could know and distinguish those starres, which alwayes are scene and neuer set, as those which are comprehended of the *Articke* circle ; from those which alwaies lie hidde and neuer rise ; as such as the *Antarticke* containes : Whence it manifestly appears, that the two Polar circles, as they are taken of the *Gracians* in all Regions, are not of the same quantity and greatness, but are greater in an oblique Spheare then in a right : but our Polar circles are at all places alike in their quantity. Of these, the one termed *Articke* in the Earth passeth by *Islandia*, the top of *Norway* and *Finland*, with many adioyning Islands, and the Southerne part of *Groen-land*, as may appeare by our ordinary Geographicall Mappes. The other Polar circle called *Antarticke*, passeth through the South part of the world (as yet) vndiscouered, except for some fewe parcels, as *Terra del Fango*, and *Pstacorum Regio*, with some-what more, lately discouered by the Spaniards. The chiefeſt vſe as well of these, as other Parallels, is to diſtinguiſh the *Zones* and *Climates* in the Globe, whereof we ſhall haue occaſion to treat hereaſter.

2.1 The Nameleſſe Parallels are ſuch as are not knowne by ſpeciall Names, nor of ſo great vſe in Geography.

These

These namelesse Parallels may be well vnderstood by that which we haue aboue spoken: for howsoeuer they be not calld by particular and speciall names, yet are they all of the same nature: All these Parallels beside the \textcircumflex Equatour, though infinite in number, may notwithstanding in this place be reduced to the number of the Meridians; because they are drawne through the opposite points of the Meridian semicircle; so that we might account 180; but yet there are, not so many painted on the face of the *Artificiall* Globe; wherefore *Ptolomy* with the ancients, haue distinguished the Parallels on both sides, North and South, beginning from the \textcircumflex Equatour at such such a distance, that where the day shalld increase one quarter of an houre, a new Parallel should be placed: so that the longest day of one Parallel, should exceed the longest day of another Parallel by one quarter of an houre. Every one of these Parallels, is supposed to be diuided into 360 Degrees, as all the rest of the other circles: yet are we to note that the degrees and parts of a greater circle, are greater; of the lesser, lesse, according to the proportion of the said circle; so that the same proportion that a great circle hath to a lesse, the same haue the degrees and parts of a quartre circle, to the degrees and parts of the lesser; as may be gathered from the first proposition of the second booke of *Theodosius*: now to know rightly this proportion, we must first finde out the summary declination for euery region, which being once found, we may proceed in this manner, by the doctrine of Triangles.

Let the sine of the Complement of the Declination of the lesser Circle be multiplied by the whole Circle, and the product be diuided by the totall sine, there will arise the number of Degrees of the lesser Circle, such as whereof the greater consists.

The reason hereof is shewed in *Geometry*, and therefore need we not to insert a demonstration; for there we learne, that

as the totall sine is to the sine of the Complement of the Declination of any Parallell, so is the Peripherie of the greater circle, to the Peripherie of the Parallell: As for example, if wee would know what proportion the Aequator hath to the Parallell, which passeth by the Verticall point of *Rome*; whose Declination is about 42 Degrees; I multiply the sine of the Complement of this Declination, that is, the sine of 48 Degrees; to wit, 74314, by 360; the product whereof is, 26753040; which I diuide againe by 100000, and find 267 degrees, and $\frac{1}{2}$: whence I gather that the Aequator to the Parallell of *Rome*, or a degree of the Aequator, to a degree of the Parallell of *Rome*, hath the same proportion that that 360 hath to 276 $\frac{1}{2}$; which is the same that 4 hath to 2.

22. Hitherto haue we spoken of the *Absolute Circles*, such as are the Meridians and Parallels: we are to treate in the last place of a *Relative Circle*, which is conceiued in respect to our sight: this Circle is called the *Horizon*.

23. The *Horizon* is a Circle which diuides the vpper and visible parts of the Terrestriall Globe, from the lower and visi-ble.

The name of the *Horizon* is taken from the bounding or termination of the sight; because it is a Circle comprehending all that space which is visible vs, distinguishing it from the rest which lurketh invisible: as if a man should be placed in a high and eminent place of the Earth, and should looke round about him euery way to the *East*, *West*, *North*, and *South*; Hee will seeme to see the heauens on euery side to concurre with the earth: so that beyond it, can be seene nor heauen nor earth: which concurrence of the heauens with the earth, will describe unto vs the *Horizontall Circle* for that place assignd. But
heere

heere we are to note, that the Horizon is two-fold; either the *Rationall* or *Sensible* Horizon. The *Rationall* precisely diuides the *Globe* into two æquall parts: But the *sensible* or *apparent* *Horizon*, is no other then that *Circle* in the *earth*, which is designed out by the *sight*, from which the name seemes to be derived. This *sensible* *Horizon* differs from the *rationall* diuers wayes; first, because the *rationall* diuides the *whole* *spheare* into two æquall parts; but the *sensible* into two vnæquall parts. Secondly, because the *rationall* is alwayes certaine and the same, in the same place, and of alike greatnessse; whereas the other is greater or lesser, for the condition of the place or sight; for the *semidiameter* of the *rationall*, is the same with the *semidiameter* of the *earth*; but the *semidiameter* of the other, seldome or neuer exceeds 60 miles on the *Earth*. Thirdly, because the *rationall Horizon* passeth by the *Center* of the *Earth*; whereas the *sensible* toucheth onely the *surface* of it, in that point where the *Inhabitant* standeth: all which differences may be true.

in this Figure;

wherein the Line

C D, represents

vnto vs the *sensible* *Horizon*: the

Line A B the *rationall*: The for-

mer is called *Naturall* or *Physical*;

because it comes vnder the mea-

sure & apprehen-

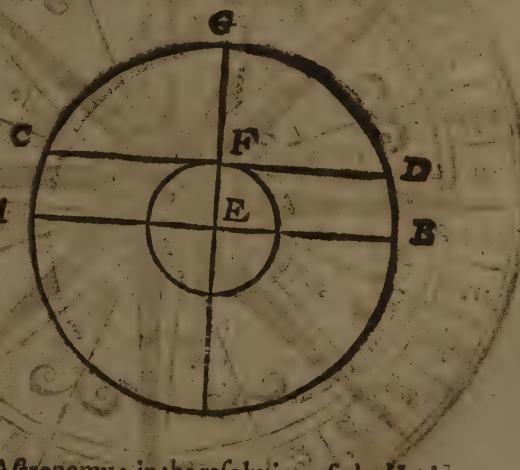
sion of the sense;

the other *Astro-*

nomicall, because

it is of great vse in *Astronomy*: in the resolution of the *Horizon* into his parts, we ought to consider two things: first, the *Poles* of the *Horizon*; Secondly, his *Peripherie*, or *circumfe-*

rence: The *Poles* are commonly called *Zenith* or *Nadir*: The



Zenith is the Verticall point, directly placed ouer our Head: whereunto is opposite on the other side, the Nadir directly vnder our soote, and therefore may be called the Pedall point. The parts or intersections in the circumferences, are designed out vnto vs, by certaine lines, discouering the coasts in the Terrestriall Globe: These lines are called either *windes* or *Rhumbes*: The windes with the *Gracians* were onely 8: But the latter Nauigators haue increased them to the number of 32, whereof foure were called *Cardinall*; to wit, such as are directed to the soure coastes of *East*, *West*, *North*, and *South*: The other are *Collateral*, being placed on each side of the Cardinall windes. The *Rhumbes* are Lines passing by the Verti-



call point of any place, as you may see in the Compasse going before: Now because the Rhumb be answares to two coasts or windes; the number of the Rhumbes is but halfe the number of the windes; to wit, 16. Here it is to be noted, that a Rhumb differes from a Wind; whereas a Rhumb is one line, Pointing out vnto vs, two windes or coasts: These Rhumbes as they are conceiuied in the Globe, were thought by *Nonnius* to be the portions of greater Circles: But learned M^r. *Hues* in his booke, out of vndoubted principles, strongly confutes him. The groundes which he takes are these: First, that all Meridians of all places passe the Pole, and cut the ~~Meridians~~ quatour and all his Parallels at right Angles. Secondly, If our course should be directly any way else, then towards one of the Poles, a new Meridian must succeed, and a new Horizon. Thirdly, that the Iron Needle being touched with the Load-stone, shewes the common section of the Meridian and the Horizon, and on one side perpetually respects the North, on the other the South. Fourthly, the same Rhumb cuts all the Meridians at all places at æquall Angles, and every where respects the like coasts in the world. Fiftly, that a greater circle drawne by the Verticall points (if remoued from the ~~Meridians~~ quatour) cannot cut diuers Meridians at æquall Angles. Sixtly, a greater circle drawne by the Verticall point of any place, makes greater Angles with all other Meridians then with that, from which it was first drawne: whence it is necessary, that the line which shall be supposed to make Angles with diuers Meridians (as the Rhumbes) should be bowed toward the Meridian. I know not what would be more said against the opinion of *P. Nonnius*, who would haue all the Rhumbes to be portions of greater circles. To illustrate further the nature and use of the Horizon we will insert these Theoremes.

2. The Sensible and Rationall Horizon in the Earth, are much different; in respect of the Firmament, all one.

Ptol. diff. 1.
cap. 5.
alph. 6. diff. 6.

It may be gathered out of the suppositions of *Ptolemy* and *Alphraganus*, and almost all other Astronomers, that no man being placed on the surface of the earth can precisely see the halfe of it. For that Horizon which terminates our sight, as wee haue shewed, is a plaine superficies every way circularly extended in the Earth, in such sort as men placed, either in the Sea in a ship, or in a great field or Countrey, would think the visible part of the earth to be plain, whose ends wold seeme to touch the Heauens. Whence must needs come to passe that such an Horizon canot divide the Spheare of the earth into two æquall parts. For so much will be found wanting, as is measured betwixt that superficies which toucheth the earth, and that which passeth by the Center of it, æquidistant from the other: for this later only can divide the earth into 2 æquall parts.

Prop. 11. lib. 1. parts, according to *Theodosius*, and may well bee seen in the former figure, wherin are expressed both *Horizons*, as wel the visible as invisible, touching the Spheare in a point on the superficies: as the *Rationall* passing by the Center. Neuerthelesse we must consider, that the quantity intercepted betwixt these two *Horizons* in the Terrestriall Spheare, is of hitle or no moment, compared with the whole frame of the Heauens: For sith the Heauens are so farre distant from vs, it will come to passe that if two æquidistant lines should be drawne, the one from the *Eye*, the other from the *Center* of the Earth to the *Firmament*, they would according to sense, appeare one and the selfe-same; by reason of the wonderfull distance: as wee see in a long Gallery, whose walls haue an æquall distance the one from the other; the walls will notwithstanding (according to *Opticall* principles) seeme widest where they are nearest, and to close and shut vp at the ends, or at least to concurre nearer: much more must we imagine this to happen in the sight, if we compare the greatnessse of the *Firmament* with the Spheare of the Earth, in whose magnitudes wee shall finde an incomparable disparity. This will appear by the Apparences: for we shall see the sixe figures of the *Zodiacke*, conspicuous above our *Horizon*, and the other sixe vnder it, hid from our sight: Also the *Sunne* and *Moone*, when they are diametrallly

Pag. 149.

trally opposed, almost at the same moment will appeare, the one in the East, the other in the West: at least the one will rise soone vpon the setting of the other: And (if we beleue *Pliny*) the Moone was obserued to be eclipsed in the East point; the Sunne at the same time being in a sort aboue the Horizon in the West. Such an Eclipse could not happen without a diametral opposition of the two lights, and therefore can the Sensible and the Rational Horizon haue no sensible difference in respect of the Firmament.

2 *The sensible Horizon may be greater or lesser according to the nature and disposition of the place.*

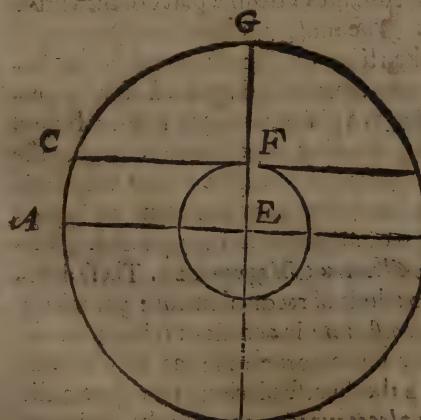
In this consideration we take no notice of the difference of sightes, whether they be weaker or sharper; but suppose an eye sufficient to kenne so farre in the Earth, as the place will permit. The difference then betwixt diuerse Horizons must bee sought out in the condition of the place. A Sight placed on the top of a high mountaine, may see much farther then one in a low valley, compassed about with hills; forasmuch as the Semidiameter of the sensible *Horizon*, which is equall to the Rayes or Lines drawne from the extreame parts of the visible Earth, are much greater. The most indifferent iudgement of this *Horizon*, may be taken from the superficies of the Sea beyond sight of land: for a man thereon sayling in a ship, may perceave the surface of the Sea as a plaine, on every side to bound the sight in a round circle, seeming together to terminate the end of the Earth, and protension of the sight. What the Semidiameter of this Horizon should be, hath not beeene yet agreed, vpon by all: *Erasosthenes* would haue it to be 44 miles. *Macrobius* 23. *Proclus* 250. *Albertus Magnus* 125. These differences seemd too great to admit of reconcillement: yet taking into our consideration the disparity in accouët of miles betwixt the *Moderne* and *Ancient* Cosmographers; as also betwixt the *Greekes* and *Latines*: 2 the diuerse placing of the sight. 3 the various disposition of the places wherem they tooke their obseruations, with other circumstances, we should diminish much

of admiration. But diuerse others whose opinion is more approued by moderne Cosmographers, haue defined it to bee about 63 miles. The cause why this Horizon should be so little in respect of the Rationall which passeth by the Center, is the roundnesse of the earth interposed betwixt the sight & the farther parts, which we haue formerly proued.

3 The eye may be so placed on the Earth, as it may behold the whole Hemisphære of the heauens, and yet no part of the Terrestriall sphaere.

This may seeme a paradoxe with vulgar iugements; but it wants not a demonstration drawne from Astronomicall and Optick principles. To explaine which, we must suppose out of the grounds already granted, 1 That the *sensible* and *Rationall Horizon* in respect of the Heauens, ought to bee esteemed one and the selfe same, by reason of the great distance and disproportion betwixt the Earth and the Firmament. 2 That the eye of the beholder is in this sort supposed to be in the Center; because in this consideration the distance betwixt the superficies of the Earth, and her Center, is insensible. 3 That the visuall Ray wherein the sight is carried, is alwaies a right line. Now

suppose (according to our former figure) the Center of the eye wherein consisteth the sight, to be in the point of the Terrestriall surface F, the distance (as wee said) betwixt F and E the Center being insensible; the eye is imagined in the center: likewise the Horizon



rizons CFD, and A E' for the same cause in respect of the Heavēs are to be esteemed one & the same; because CA & DB haue no sensible difference. It is thē manifest, that the eie so placed will behold in the heauenly Spheare, all which is included betwixt A & B, to wit, the Hemispheare A G B, bounded by the Rationall Horizon A E B. Neuerthelesse in the Terrene Globe it can see nothing at all: For either it should see only the point F, wherein it is seated, or else some other point or part distant from it: the former canoht be admitted, because the eye being there supposed to be placed, should according to this supposition behold it selfe, which is against Philosophy: For granting the sense only a direct and not a reflexe operation, it cannot be imagined how it should perceave it selfe. Finally, it cannot see any point in the Earth besides; for then this point would either be placed aboue the point F: but this cannot bee, because F being supposed in the superficies, admits of no point higher in the Spheare, or else vnder it: but this cannot bee, because CFD being a tangent line, and touching the Spheare in F only: there cannot according to Geometricall principles bee drawne any right line from the point F, which can touch any point in the said Spheare, but all will cut it, and so the section cause impediment to the sight, the Earth being an opacous and round body.

4 From the Horizontall circle is reckoned the elevation of the Pole in any place assigned.

The finding out of the elevation of the Pole is a matter most necessary for a Cosmographer; as shall appeare after, where we shall speake of the *Latitudes* and *Climates*. It is defined to be an arch of the *Meridian* betwixt the *Horizon* and the *Pole*. For the finding out of which many waies haue beeene devised by Artificers: The first is taken from the Sunne, the second from the *Pole-starre*: From the Sun it may be performed two waies. 1 At the time of the *Æquinoxe*. 2 At any other time of the yeare. At the time of the *Æquinox* it may be found out by the observation of the Sunnes shadowe at Noone-tide, in this manner: Let the Meridian height of the Sunne be sub-

tracted from the whole quadrant, which is 90 degrees: there will remaine the distance of the Zenith to the Equator, which is equal to the elevation of the Pole. In the second place at any time of the yeare to knowe the elevation of the Pole out of the Meridian height of the Sunne, it is necessary out of an *Ephemerides*, or any other way, accurately to finde out the place of the Sunne in his *Eclipticke* for the day proposed, together with his declination: for the declination of the Sunne, the Sunne being in the six Northerne signes, subtracted from the Meridian altitude; or added, the Sunne being in the six Southerne signes, will precisely give the height of the Equator: or (which is the same) the Meridian heighth of the Sun in the *Equinoctiall*: which being once found, we may worke as in the former. By the Pole-starre we may likewise finde it out, if wee obserue it three distinct times in the same night: for three points being giuen, every Geometrician will finde out the Center, which in this case must be the Pole. Many other waies haue beeene inuented by skilfull Astronomers, which appertaining rather to *Astronomy* then *Cosmography*, I purposely omit.

24. Concerning the Horizon, two things are chiefly to be noted, the *Inuention* and the *Distinction*. The Invention is considered either as it concernes the Zenith or Pole: or the Plaine of the Horizon. For both which we will set downe these Rules.

1. The height of the Pole subtracted from the quadrant of 90 Degrees: the residue will shew the Zenith or dist.ance of the Zenith from the Pole.

The reason is evident; because the height of the Pole, together with the distance of the Pole and the Zenith make an arch, which is a whole quadrant: so that the height of the Pole subtracted, the distance will remaine; as for example, if we put the elevation

eleuatiō of the Pole here in Oxford, to be $51\frac{1}{2}$ degrees or thereabout (as hath beene formerly taught: Let these $51\frac{1}{2}$ degrees be subtracted from 90, then will remain $38\frac{1}{2}$, which is the true Zenith for that place.

2. A line which makes right angles with a plummet perpendicularly falling on it, will designe the Horizontall plaine.

The practise of the proposition is vsually shewed by Artificers by a certaine instrument called a *Levell*, which is made in a triangle forme: from the vertex, or head of which, a line with a plummet falls on the Basis. Now when it shall be found to be so placed, that the line and plummet falling on the Basis, shall make right Angles with it, and cut the whole Triangle into two equall halves: we may account the Base-line to be the plaine of the Horizon: For of this plaine, such is the position, that it inclines no more on the one side then on the other, but lies even: as we see in the surface of the water, when it rests quiet without motion: for how soever the water so resting (as we haue formerly demonstrated) is alwaies sphæricall, yet in a small distance in the sensible Horizon, it may to sense be represented by a plaine.

25. So much for the Inuention: The Distinction of the Horizon is into three sorts: for either it is a right Horizon, or oblique, or parallel.

26. A right Horizon is that which with the AEquator makes Right Angles.

This distinction growes naturally out of the Respect of the Horizon to the AEquator. For sith the AEquator is one and the selfe-same immoueable circle; and the Horizon is mutable and changed according to his diverse verticall points, they cannot alwaies keepe the same situation in regard one of the other. This they haue reduced into three heads: for either it is Right

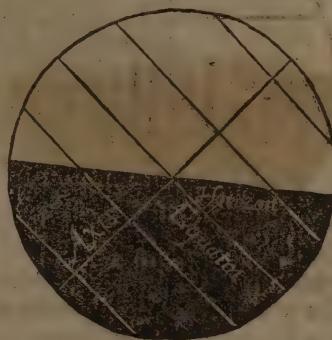
or *Oblique*, or *Parallel*. The Right is so called from the right Angles which the Horizon makes with the *Æquator*: wherein the two Poles are alwaies couched in the Horizon, and the *Æ-*



Ilands of Taprobana, and S. Thomas: but no part of *Europe* is subiect to such a Right Horizon. The cause of this variation of Horizons is the naturall roundnesse of the Earth: For the earth being supposed to be sphæricall, as we haue before demonstrated, it must of necessity follow, that the site of the Poles should be changed according to the diversity of the places. Also, because wheresoeuer wee are placed on the Earth (as wee haue shewed) all impediments of the sight, as mountaines and vallies put apart, we can behold the Hemispheare of the Heauens, which middle part being set downe is diuided from the part vnsene, by the Horizon it must needs be, that either both the Poles must be in the Horizon: and so make a Right Spheare: or at least one must be aboue and seen, and the other hid from the sight, and so much as one is eleuated aboue the Horizon, must the other be couched vnder it. For otherwise wee should see more or lesse then a præcise moity, or halfe of the Heauens: sith the Poles differ one from the other the halfe of the whole Heavens: to wit, by the Diameter of the world.

27. An oblique Horizon is that which with the Equator makes oblique Angles. Those Inhabitants are said to haue an oblique Horizon, whose

site an position declines somewhat from the *Æquator*, either to the North or South towards either Pole: yet so that the Pole be not eleuated so high as 90 Degrees: for then it becomes a *Parall. Horizon*, as we shall shew in the next. The representation of such an oblique Spheare may bee feene in this Diagram: wherein the Horizon cuts the *Æquator* at oblique Angles, whence it is called *oblique*. *Clavins* seemes to adde another reason of this appellation: to wit, because in such an Horizon one Pole is alwaies eleuated aboue, & the other hid: but this reason seemes too generall, as that which agrees not only to an *Oblique*, but also to a *Parallel* Spheare. From this Horizon, by *Johannes de Sacrobosco*, the Spheare is called *Artificial*: because, as *Clavins* conieclures, it is variable, & doth not naturally diuide the Globe. For whereas the Horizon of the Right Spheare passeth by either Pole, it seemes by it selfe (as it were) Naturally and Directly to diuide the Spheare: and this diuision is no way variable, as that it should bee more or lesse Right: but contrariwise in the oblique Spheare, sith one Pole is placed aboue, and the other beneath, it seems to be placed out of his naturall site and position. Moreouer this Oblique Horizon is variable according to the diuersity of habitations, so that it may be to some more, to others lesse Oblique: for so much the more Oblique must it bee, by how much the nearer it is placed to the Poles. The Inhabitants of an Oblique Spheare, are such as are seated betwixt the *Æquator*, and either of the Tropicks of *Cancer* and *Capricorne*, or such as dwell betwixt either Tropick and the Polar circle.



28. A *Parallel* Horizon is that which lies Parallel to the *Æquator*, making no angles at all with it.

Such

Such a kinde of Horizon those Inhabitants are said to haue, which are included betwixt the Poles of the world, and the Polar circles; whose Horizon cuts not the \textcircumflex Equatour at any Angles at all, either Right or Oblique: but lies Parallel vnto it, as



we see in this Figure here set downe. Some haue reduced this kinde of Spheare to an Oblique Horizon: in regard that in this site our Pole is exaltated aboue the Horizon, and the other depressed vnder: in which opinion *Cluimus* seemes to second *Iohannes de Sacrobosco*, on whom he comments. But this is ridiculous; because the Spheare is called Right or Oblique (as we haue taught) from the Angles which the Horizon makes with the Equator: wherefore that Horizon which makes no Angles at all, cannot bee called either Right or Oblique, but is necessarily distinguished from either. On this distinction of Horizons is grounded the diuision of the Inhabitants of the Earth according to three kinds of Spheares: of whose accidents and proprieties wee shall more fully treat hereafter in the distinction of the parts and Inhabitants of the Terrestriall Spheare because such proprieties cannot so well be gaught without the knowledge of the *Artificiall Spheare*, whose Nature and Fabbricke we shall labour (God willing) in our next Chapter to vnfold.

CHA. P. VII.

Of the Artificiall Representation of the Terrestriall Spheare.

HAving hitherto treated of the Terrestriall Spheare, as it is Naturall or re-

all: we are in the next place to speake of the Artificiall Globe: The Artificiall Globe is an expression or imitation of the Spheare of the Earth.

- 2 The Artificiall imitation of the Earth is either *Common* or *Magneticall*. The common is againe twofold; either in the *Globe*, or in the *Geographicall Mappe*, or *Table*.
- 3 The Geographicall Globe is a round solid Bodie, adorned with Lineaments and pictures, seruинг for the vse of Geographers.

Who was the first Inventour of this Artificiall Globe, it is not euident: some thinke with *Pliny*, that it was found out by *Atlas*, and carried into *Greece* by *Hercules*. Others haue ascribed it to *Anaximander Milesius*; some to *Musaeus*, as *Digenes Laertiush*: others to other Authors, amongst whom *Architas Tarentinus* is not forgotten, as one that was esteemed the rarest Mathematician of his time. But all these were out-stripped by *Archimedes* the *Syracusan Mathematician*, who is said to haue composed a Spheare of transparent glasse, representing vnto the life the whole frame of the Heauens, wherein the *Sun*, *Mone*, and *Starres* with their trne motions, periods, and limits were shewed to the sight, in such sort, as if it were naturall: whereof *Claudian* the Poet elegantly wrote in these Verses,

Claudian. in Epigrammat.

*Iupiter in parvo cum cerneret athera vitro,
Risit, & ad Superos talia dicta dedit:
Huccine mortalis progesa potentia cura?
Iam meus in fragili luditur orbe labor.
Iura poli, rerumq; fidem, legesq; Deorum,
Ecce Syracusius transtulit arte Senex.
Inclusus varijs famulatur spiritus astris,*

S

Ecce

Et vivum certis instibus urget opas.

Percurrit proprium mentitus signifer annus,

Et simulata novo Cynthia mense redit.

Iamq; suum volvens audax industria mundum,

Gaudet & humana sidera mente regi.

Quid falsa insontem tonitra Salmonea miror?

Amula natura parva reperta manus.

In a small glasse when *Ione* beheld the Skies,

He smil'd, and thus vnto the gods replies:

Could man so farre extend his studious care,

To mocke my labours in a brittle Spheare?

Heauens lawes, mans waies, and Natures soueraigne right,

This Sage of *Syracuse* translates to sight.

A soule within on various starres attends,

And moues the quicke-worke vnto certaine ends.

A faigning *Zodizcke* runnes his proper yeare,

And a falle *Cynthia* makes new monthes appeare:

And now bold Art takes on her to command,

And rule the Heauenly Starres with humane hand.

Who can admire *Salmonean* harmlesse Thunder,

When a slight hand stirres Nature vp to wonder?

But this Spheare of *Archimedes* I take to be more then an ordinary Globe commonly vsed amongst vs, as may appeare by the Poets description; so that it may rather be likened to the Spheare, lately composed by *Cernelius Trebelius*, and presented vnto *King James*. The like whereof *Peter Ranus* sayes he saw two at *Paris*; yet not of glasse, but of Iron; the one of which *Ruellius* the Physician brought from the spoiles of *Sisiliy*: the other of which *Orontius* the Mathematician recovered likewise from the *Germane* warres. But of such kind of Globes hauing neuer yet had the happines to see any, I intend no description: In the meane time our common Geographicall Globes may well serue our turnes.

4 In the Terrestriall Globe two things are to be considered: 1 The Fabriek or Structure.

2 The

2 The Use. 3 The Direction. In the former is taught the composition of the globe by resoluing of it into it's parts.

1 *The parts whereof the Globe is Geographically compounded are circles and pictures.*

To explaine the true composition of the Artificiall Globe, not Physically as it consists of timber and metall, but Geographically as it represents the Earth, we are to consider, that the parts of it are either *Externall* or *Internall*: Externall I call those parts which are without the Spheare it selfe, yet necessarily concurre to the constitution of it. These parts are such as concurre to the making of the Stock or Frame whereunto our Spheare is set: where to let passe the footing or lower board, (wherein in the old Globes was engraffed a *Marriners Compasse*, with a *Needle magnetically* touched, very profitable for the direction of the Spheare) I will onely speake of the great Timber Circle, encompassing round the whole Globe: because it more immediatly concernes our purpose. This Circle represents the *Horizon* of the Naturall Spheare: In the Globe it is made but one, not that there is but one Horizon in the whole Earth; because (as we haue taught) the Horizon is varied according to the places; but because it is impossible to point and marke out the Horizons; for all places being infinite as the Verticall points: yet may this one serue for all places, because the Globe being moueable, may apply all his parts to this circle. This Circle representing the Horizon, is diuided into three borders or Limbes: whereof the first which is towardes the Spheare, containes all the *signes* with the *Planets* thereunto belonging; euery of which is diuided into 30 Degrees, which in the Timber Circle are described by set numbers and markes. The second which in the middle-most and longest, containes the *Calendar*, with the *Golden number*, and severall names of all the *Feasts* throughout the year. The third and last is of the 22 Windes, seruing chiefly for the use of *Marriners*, and may serue many waies for a *Geographer* to distinguish the *Coasts* and

points of the Earth. But of these three borders distinguished in the Horizon, only the last hath use in *Geography*; the other two are in themselves Astronomical, and placed in the Geographi-
call Globe rather for ornament, then use. The Internall parts of the Globe are either annexed or inscribed in the face of the Spheare. The Annexed part is that which represents the Meridian, which is a Brasen circle. For as the Externall Frame of the Globe contained the Horizon as one circle; so this Meridian is set but one, although it be in it selfe various, according to the places to which it serue. Neither without good reason is this Circle made of *brasse*, because it should serue for diuerse usses, which require that it should be often changed and turned to and fro, which being of Timber would miscarry. This Brasen Meridian meetes with the Horizon at two opposite places, cutting it at right angles, that the Spheare included might be raised and set lower, as occasion requireth. The Meridian circle is againe diuided into 4 *Quadrants*, each of which is again diuided into 90 *Degrees*; so that on the one side the 90th Degree must touch the Pole; on the other side the first degree; so that in all there will arise 360 degrees, described in the Brasen Meridian. Through this Brasen Meridian by the two Poles doth passe a line or wier, which is called the *Axell-tree* of the Globe, about the which the Spheare is turned, the ends of which are commonly called the Poles; whereof the one representing the *North* point is called the *Pole Articke*; the other shewing the *South*, is termed *Antarticke*. To this Meridian Circle in the Globe is commonly fastned a little Brasen Circle, named *Cyclos horarius*, or the *houre-circle*; but this rather appertaines to *Astronomy* then *Geography*, and therefore we will forbear to de-
cribe it: somewhat more use haue we of another Instrument fastned to the Meridian, called the *Quadrant of Latitude*; forasmuch as it may serue to measure the Distance betwixt any two places sign'd in the Globe: but in so grosse an Instrument little exactnesse can be expected. Now for such matters as are inscribed in the Spheare it selfe, (to let passe ridiculous & idle pictures vsed of Painters for ornament) they are either lines & Circles drawne on the face of the Globe: or else the pictures & deli-

delineations of Count:ies and places, marked out in visible proportions; whereof the former properly appertaines to the Spherical part of Geography; the latter to the *Topical*. The Circular Lineaments are againe twofold; either Circles necessarily appertaining to the constitution of the Globe; or else Lines thereon drawne to be considered of Mariners, which we haue before called the *Ruines*. But these Lines also (as we haue taught) appertaine to the *Geographer*, being as so many sections of the Horizontall Circle; because they are alwayes imagined to proceed from a Verticall point wherein they meet. The Circles panted on the Globe are either the *Parallels* or *Meridians*, whose description we haue set downe in the chapter before: Amongst the Parallels the most remarkable is the *Æquator*, which is made greater then all the rest, in forme of a bracelet, distinguished into degrees, and marked at every 10. degrees: Next to this are the Tropicks and Polar Circles, represented only by blacke Lines, yet framed in such sort, that they may easily be discerned from other Parallels. Amōgst the Meridians the most notable is the first Meridian passing by the *Canaries*, and painted much like the *Æquator*, cut into diuers sections and degrees, in such sort as we haue described. For the *Zodiack* which is vsually pictured in the Terrestriall Globe, I hold it altogether needless in Geography, and made rather for ornament, then vse; forasmuch as the Periodick course of the Sun, deciphered by the Ecliptick, appertains rather to the *Theory of the Planets*, which is the hardest part of *Astronomy*. The proportion of these Circles, Site, and Distance is taught before, and needs no repetition, sith it is the very same in representation on the face of the Globe, which is really in the Earth it selfe. For the Pictures and Topicall description of the Earth, we refurre it to the second & third part of this Treatise; where we shall haue occasion to speake of Countries and Regions, with their severall qualities, accidents, and dispositions.

2. *The vse of the Artificiall Globe is to expresse the parts of the Earth so farre foorth as they*

S 3. *hanc*

haue a diuerte situation aswell one in respect of another, as of the Heauens.

The vse of the Artificiall Globe is two-fold, either generall or speciall: the Generall is expressed in this Theoreme: the Speciall shall be shewne in diuerte speciall propositions hereafter as occasion shall serue:

5 The Direction is taught in the Rule.

- 1 The Meridiano for the place being found by the Sunne or Compasse: 1 Let the Globe bee so set, that the North Pole respect the North, the opposite the South. 2 Let the Pole in the Meridian of the Globe be set according to the elevation of the Pole at the place assigned.
- 6 A Geographicall Mappe is a plaine Table, wherein the Lineaments of the Terrestriall Spheare are expressed and described in due site and proportion.

Some would haue the name of a Mappe to be drawne from the lineaen furniture wherewith it is endorsed; which is not unlikely, in regard of the affinity of the words in Latine. But more significantly by others it is termed a Geographicall Table or Chart: A Mappe differs from a Globe, in that the Globe is a round solide body, more nearely representing the true figure of the Earth, whereas contrarywise the Charts of themselves are plaine, though representing a Spheare, invented to supply the want of a Globe. For whereas a Globe is more costly to be procured of poore Students, and more troublesome to be carried to and fro; a Mappe is more cheape to be bought, & farre more portable: And how soever it be not so apt an expession as the Globe, yet are there few matters represented in the other, which may not in some sort find place in this. And certainly

tainly such is the vse and necessity of these Tables, that I hardly deeme him worth the name of a Scholler, which desires not his Chamber furnished with such ornaments. It is written of that learned man *Erasmus Roterodamus*, that hauing seene 50 yeares, he was delighed so much with these Geographicall Mappes, that vndertaking to write Comments on the *Actes of the Apostles*, he had alwayes in his eye those Tables, where he made no small vse for the finding out of the site of such places whereof he had occasion to treate. And it were to be wished in these dayes, that yong Students instead of many apish and ridiculous pictures, tending many times rather to ribaldry, then any learning, would store their studies with such furniture. These Geographicall Mappes are of two sorts, either Vniuersall or Particular: The Vniuersall are such as represent the picture of the whole Earth. The particular are such as shew only some particular Place or Region. These particular Tables are again of two sorts; some are such as describe a place in respect of the *Heavens*, whereon are drawne the Geographicall lineaments by vs described, at least the chiefeſt: Some again are such as haue no respect at all to the Hesuens; such as are the Topographicall Mappes of Cities and Shires, wherein none of the Circles are described. For the Vniuersall & first sort of particular Mappes, there is no question but they properly appertaine to Geography: But the later deserue much leſſe conſideration, as being too ſpeciall for this generall Treatise.

7. The Geographicall Mappe is twofold: either the *Plaine Chart*, or the *Planisphere*: The *Plaine Chart* we call that which conſiſtes of one face and Right lines.

Such a Chart we find commonly ſet foorth vnder the name of the *Mariners Sea-Chart*: for howſoever it ſeemeſ to haue chiefeſt vſe in Navigation, yet is the Nature & vſe of it more generall: as that which not onely exprefſeth the *Sea*, but the whole Terreſtriall *Globe*: For aſmuch as the *Parallels*, *Meridians*,

dians, and Rhumber, whereof primarily it consists, are circles common to the whole, and not appropriated to either part.

3 In the *Plaine-Chart* we are to consider. Two things. First the *Ground*. Secondly the *Inscription*. The *Ground* is the space or Plat-forme wherein the Lines are to be inscribed: the *Inscription* teacheth the manner how to project the Lines.

In the Chart two things are remarkable; to wit, the plaine whereinto the Lines are inscribed: Secondly the Lines or Inscription it selfe: so we are heere to handle two points: First how this *Plaine-Chart* should be conceiuied to bee produced out of the *Globe*; whereof it is a representation. Secondly, what rule or methode we ought to vse for the inscription of the Meridians, Parallels, Rumbes, and other Lineaments thereunto annexed. Both which depend on these Propositions.

I. *The Geographical Chart is a Parallelogramme conceiuied to be made out of a Spheare, inscribed in a Cylinder, every part thereof swelling in Longitude and Latitude, till it apply it selfe to the hollow superficies of the said Cylinder.*

This Theoreme seeming at the first obscure, consists of many parts, which being once opened, will soone take light. First then to know the *Ground-work* of this *Parallelogramme* thus defined, we must suppose a Sphæricall superficies, Geographical or Hydrographical, with Meridians and Parallels to be inscribed into a concave Cylinder, their Axes agreeing in one. Secondly we must imagine the superficies thus inscribed, to swell like a bladder, blowing æqually in every part, as well in Longitude, as Latitude, till it apply it selfe round about, and all along towards either Pole, vnto the concave superficies of the Cylinder; so that each Parallel on this superficies, successively growes

growes greater from the \textcircumflex Equinoctiall towards either Pole, vntill it challenge \textcircumflex quall Diameter with the Cylinder; and likewise all the Meridians growing wider and farther off, till they be as farre distant euery -where as is the \textcircumflex Equinoctiall one fro the other. Hence may easily be vnderstood the true Matematicall production or generation of this part: for first of a Sph \textcircumflex ericall superficies it is made a Cylinder: and secondly of a Cylinder it is made a Parallellogramme, or plaine superficies: For the concave superficies of a Cylinder is nothing else but a plain Parallellogramme, imagined to be wound about two \textcircumflex quall \textcircumflex quidistant circles, hauing one common Axle-tree perpendicular vpon the Centers of them both; and the *Peripheries* of them both, \textcircumflex quall to the length of the Parallellogramme, as the distance betwixt those Centers is \textcircumflex quall to the breadth thereof: In this Chart so conceiued to be made, all Places must needes be situate in the same Longitudes and Latitudes, Meridians, Parallels, and Rumbes, which they had in the Globe it selfe; because we haue imagined every point betwixt the \textcircumflex Equatour & the Poles, to swell \textcircumflex equally in Longitude and Latitude, till it apply it selfe to the concavity of the Cylinder: so that no Pole can be displaced from his proper seat, but only dilated in certaine proportion. And this I take to be the best conceit for the ground-worke or platorme of this Geographicall Chart.

2. Except the distances betwixt the Parallels in a Plaine-Chart be varied, it cannot bee excused from sensible errore.

I hath bin thought by many Geographers, that the Earth cannot aptly according to due symmetry and proportion be expressed in a plain superficies, as it is in the Globe; forasmuch as that which is ioyned and vnited in the Globe, being of a Sph \textcircumflex ericall figure, is in the Mappe extended and dilated to a diuerse longitude and latitude from that Sph \textcircumflex ericall delineation: and although it hath bin generally conceited by many writers, that no due proportion could be obserued in a Sph \textcircumflex ericall superficies, without sensible errore: yet most exception hath bin made against this Chart here mentioned, consisting of one face

and streyte lines, which in substance (if we consider the Circles) differs not from the Nauticall Chart: of whose errorrs *Martin Cortese, Peter Nonnus*, and many others haue complained: which escapes are excellently opened and reformed by our Countryman *Edward Wright* in his Correction of Nauticall Errorrs. The reason or ground which drew these men to think that the Earth could not bee proportionably described in a plaine superficies, proceeded from the common proportion of the Lines and Circles on the Chart. For supposing the Parallels cutting the Meridians at æquall Angles, to obserue an æquall distance every-where one from the other; these errorrs and absurdities must of necessity ensue. First, what places soever are delineate in the ordinary Chart, the length of them from East to West hath a greater proportion to the bredth from North to South then it ought to haue, except onely vnder the Æquinoctiall: and this errorr is so much the more augmented, by how much those places are distant from the Æquinoctiall: for the nearer you approach the Pole, the proportion of the Meridian to the Parallel still increaseth; so that at the Parallel of 60 degrees of latitude, the proportion of the length to the bredth is twice greater then it ought to be; forasmuch as the Meridian is double to that Parallel, and so in all the rest: whence as *Edward Wright* obserues, the proportion of the length of *Friesland* to the bredth thereof, is two-fold greater then in the Globe which expresseth the true proportion; because the Meridian is double to the Parallel of that Iland. In like sort it is plaine, that in the Ilands of *Grock-land* and *Groen-land*, the length to the bredth hath a foure-fold greater proportion in the common Chart, then in the Globe; because the Meridian is foure-fold greater then the Parallel of those places. Wherefore it cannot be conceited, that the manier of finding out the difference of Longitude by the common Chart, can be any-where true without sensible errorr, except onely vnder the Æquinoctiall, or neare about it; because in no other place the Parallel is æquall to the Meridian. In other places the errorr will be sensible, according to the difference of the Meridian, and Parallel of that place: whereas if the contrary

were

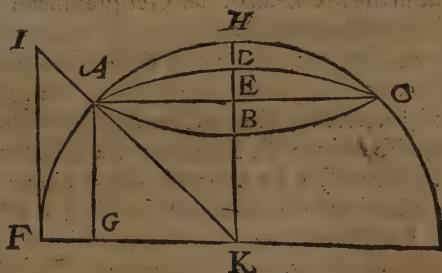
were granted, it would follow, that two ships sayling from North to South, vnder two severall Meridians, would keepe the same distance the one from the other of longitude neare the Pole, which they had neare the \textcircumflex Equator; which is impossible: because Meridians cannot be Parallell the one to the other, but by how much they approach the Pole, by so much they are nearer, that in the end they all concurre and meet in the Pole it selfe. Secondly this common Chart admitted, there would arise great errors not only in the situation of diuers places, which appeare to be vnder the same Meridian, but also in the bearing of places one to the other. The reason is manifest, for that the Meridian is a certaine Rule of the Site and position of places: therefore whensoeuer any errore shall be committed in the Site and Position of the Meridian, there must needs follow errors in the designation of the Rumbes, and other points of the Compasse. And therefore every respective position of place to place, set downe in the common Chart, cannot be warranted. A pregnant example we haue in the way from *India*; for the Promontory of *Africke*, called the Promontory of three Points, hauing of Northerne latitude 4 Degrees and a halfe, & the Iland of *Tristan, Acugna*, hauing 36 degrees of Southerne latitude, are in the common Chart set vnder the same Meridian: But the Chart sheweth the distance betweene these Ilands, and the *Cape of good Hope* to come neare to 400 leagues; both which cannot stand together; for if all the coast from the Promontory of Three Points, vnto the Cape of Good-hope be rightly measured, and the Promontory of Three Points lye also vnder the samme Meridian with those Ilands, yet must the distance be much lesse: But if it be not lesse, it cannot stand with reason that it should haue the same Meridian with the Promontory of Three Points, but must needs lye more Westward. Thirdly, there must needs arise a greater errore in the translating Sea-coasts and other such Places out of the common Chart, into the Globe; because they haue only a respect to the Numbers of Degrees of Longitudes and Latitudes found therein; so that not only errors appeare in the Sea-Chart, but also otherwhence derived. These and many more errors haue bin

detected in the common Sea-chart, which (as we haue said) respecting the circles, ought to be imagined one & the selfsame with the projection of the lines in a Geographical table; which ouer-sight *Ger. Mercator* in his vniuersall Map seemes to correct: yet leaues no demonstration behind him to teach others the certain way to draw the Lines, as Meridians, Parallels, & Rumbes on the Chart, in such sort, as these errors might be prevented, and the due proportion and symmetry of Places well obserued. But our industrious Countryman hath waded through all these difficulties, and found out the true demonstration of a projection of these Lines to be inscribed in the Chart in such sort, as no sensible error can shew it selfe, from whose copious industry we will extract so much as may serue our purpose, only contracting his invention into a shorter methode, hauing many matters to passe through in this Treatise.

**2 The Distances of the Parallels in the Chart
must increase proportionably as the Secantes
of the latitude.**

It hath bin a conceiued error (as we haue shewed) that all the Parallels in the Chart here mentioned, should euery-where keep the same Distances one from the other, from the \textcircumflex Equator to the Poles; yet because no man (for ought I know) hath out of Geometricall grounds discouered the true proportion, beside my fore-named Author; I must heerein also follow his direction as neare as I can in his owne footsteeps; because I would not any way prejudice his Invention. First therefore we must consider in that Chart, because the Parallels are æquall one to the other, (for euery one is set æquall to the \textcircumflex Equinoctiall) the Meridians also must be Parallel and straight Lines, & by consequence the Rumbes, making æquall angles with every Meridian, must be also straight lines. Secondly, because the sphericall superficies whereof the Chart is imagined to be produced, is conceiued to swell and enlarge it selfe euery-where æqually, that is, as well in Longitude as Latitude, till it accommodate it selfe to the hollownesse of the Cylinder round about; therefore at every point of Latitude in this Cylinder so dilated, a

part of the Meridian obtaines the same proportion to the like part of the Parallell, that the like parts of the Meridian and Parallell haue to each other in the Globe without sensible error. Now forasmuch as like parts of the wholes, haue the same proportion that these wholes haue; therefore the like parts of any Parallell or Meridian of the Spheare haue the same proportion that the same Parallels and Meridians haue: For example sake, as the Meridian is double to the Parallell of 60 Degrees, so a Degree, Minute, or other part, is also double to a Degree, Minute, or other part of the Parallell; and what proportion the Parallell hath to the Meridian, the same must their Diameters and Semi-diameters haue one to the other: as is taught by Geometricians. Now the Sine of the Complement of the Parallels latitude or distance from the \textcircumflex Equinoctiall, is the semi-diameter of the said Parallell; as in this Diagramme here inserted may easily appeare: for AE the sine of AH the complement of AF, the latitude of the Parallell ABCD from the \textcircumflex Equinoctiall is the semidiameter of the Parallel ABCD; & as



the semi-diameter of the Meridian or whole sine is to the semidiameter of the Parallell; so is the secant or Hypotenuse of the Parallels latitude to the semi-diameter of the Meridian, or to the whole sine, as FK (that is) AK, to AE (that is) GK, so is IK to FK: therefore in this Geographieall Chart, the semi-diameter of each Parallell being α equal to the semidiameter of the \textcircumflex Equinoctiall or whole sine, the parts of the Meridian at every point of latitude, must of necessitie encrease with the same proportion wherewith the Secants of the Arch contained betweene these points of latitude and the \textcircumflex Equinoctial encrease: out of which Geometricall

grounds thus explained, will arise a certaine and easie methode for the making of a table by the helpe of Trigonometry, whereby the Meridian in any Geographical or Hydrographical table may truly and in due proportion diuide it self into parts, from the Equinoctiall towards either Pole: for taking for granted, that each distance of each point of latitude, or of each Parallell one from the other, to comprehend so many points as the secants of the latitude of each point or Parallell containes, we may draw out a table by continuall addition of the secants answerable vnto the latitude of each Parallell, vnto the summe compounded of all the former Secants; beginning with the secants of the first Parallels latitude, & thereunto adding the second Parallels latitude, & to the summe of both these, adding the third Parallels latitude, & so foorth in all the rest: and this Table will shew the sections and points of latitude in the Meridian of the Geographicall Mappe; through which sections the Parallells ought to be drawne: which Table we haue lately set out by *Edward Wright* in his Correction of Nauticall Errours, to whom for further satisfaction in this kind, I referre the diligent Reader. Out of the same grounds we may also deduce the Rumbes: for sith that the Chart (as we haue shewed) is nothing else but a plaine Parallelogramme, conceiued to be made of the extension of a Sphæricall superficies, inscribed in a concave Cylinder, it must needes be that the Rumbes make & quall Angles with all the Meridians. Therefore if in the Chart a circle be drawne, diuided into 32 & quall parts, beginning with the *Meridian*, passing by the Center of that Circle, the lines drawne from the center of these sections, will be the Rumbes for that place.

¶ Of the Geographicall Plaine-Chart we haue spoken; It behoues vs next to treat of the Geographicall Planisphære. The Planisphære is a table or map of two faces, whereon the lines are projected circularly.

Betwixt

Betwixt the Planisphere and the Plaine-Chart, a double difference may be obserued: 1 That the former consists altogether of right lines, aswell in regard of the *Parallels* as *Meridians*: whereas the later is composed of circular or crooked lines, aswell as right. 2 The former may well be expressed in one forme or front, as we may see not only in the Nauticall and common Chart, which we haue shewne to be all one with the other in respect of these Lines; but in many other common Mappes, as namely those of *Hondius*, whereas the Planisphere cannot be expressed without two faces or Hemispheares; whereof the one represents the Easterne, the other the Westerne part of the Terrene Globe: For herein we must imagine a Globe to be cut into two æquall Hemispheares, which are at once represented to our sight: of this Description of the Earth by crooked Lines, *Ptolomy* in his 24 Chapt. of his Geography hath taught vs two wayes: whereof the first depends from the aspect of a Spheare, turned and moued round, in which all the Meridians are described as right Lines; but the Parallels as circumferences or crooked Lines. The other Delineation takes his ground from a Spheare presented to the sight, not moued, but restng stil in his place, in which both Meridians and Parallels are drawne circular. These two wayes of *Ptolomy* (howsoeuer iudiciously invented in those times, wherein a small part of the Earth was discouered, and Geography very vnperfect) haue bin by later Geographers much reformed and corrected. Yet amongst the later haue not all expressed themselves alike: some haue pourtrayed out th. Earth in fashion of a Heart; some according to *Orontius* *Gerard*; *Mercator*; other figures: but in this (perhaps) as Painters, they haue bin more indulgent to fancy, then common vse: others haue gone about to expresse the Globe of the Earth in Elipticke Lines, which the *Machanicians* call oval. But we as well in this as other matters, preferring choice before abundance, will content our selues with one or two, which vse hath stampt more current, and experience hath found most vsefull: to which as a ground we will premisse this Theoreme.

1. *The Planisphere is grounded on a certaine aspect*

aspect of the Terrestriall Spheare, wherein the Eye of the beholder is so conceiued to be fixed in some point of the Globe, that it may see the one halfe or Hemisphære.

Concerning the position of the Eye, two things are here remarkable: 1 Where the Eye is supposed to be placed either aboue the convexe superficies, or in the concave: some seeme to place it aboue the convexe superficies; of which opinion Gemma Frisius seemes to be, who would haue the Eye to be set at an infinite distance: others although not admitting of such an infinite distance, deny not the Eye to be aboue the convexe superficies: but neither way can be warranted: Not the former, because of the impossibility of the supposition. For to imagine the Eye to be set at an infinite distance, were to deny a sight or aspect which they would haue to be the ground of this projection: For no object can be perceived, but such as is bounded and determined in a certaine and proportionate space. Neither can the later way passe cleere without exception; because to such a projection, such a sight is required which can see the whole Hemisphære: for otherwise would it be vnperfect, and want of the perfection of the Globe: which containes two absolute and entire Hemispharees. But now no place can be imagined without the Globe, wherein the Eye can be so placed, as to see the one halfe or Hemisphære: forasmuch as it is impossible from the opposite points of any Diameter, to draw two tangent lines which may meet together, or cut one the other in the same point, but will be Parallell the one to the other: wherefore we may conclude, that the Eye in this projection cannot be imagined without the convex surface of the Spheare, but rather in the concave: How the Eye should be imagined to be in the concave superficies, may be in this sort explained, we must suppose a great Spheare of Glasse, or other such Diaphanous matter, inscribed with all his Parallels and Meridians, in such sort as they are represented vnto vs in the Globe, the Eye (according to opticall Principles) may be so placed neare the

Center of it, as it shall bee able to see precisely the one Hemisphære described with all his circles, as we finde it in the spheare. I say *neere* not in the Center; because the Angle of vision(as we finde it taught in the *Perfextimes*) doth not extend to a right Angle, but is somewhat lesse: 2 we must inquire in what point in the superficies the eye is placed. To which we answer, that the place of the eye is of it selfe indifferent; because it may be imagined any where in what point soeuer. Neuertheless we will only fasten on two especiall waies which are of most vse, wherein the propositions following shall informe vs.

2. This Planisphære is twofold: the first wee tearme α quinociaill, which supposeth the eye to be fixed on some point of the α quinociaill circle; the other Polar wherein the sight is conceiued to bee fixed on the Pole of the Terrestriall Globe: The ground and fabricke of the former is taught in these Propositions.

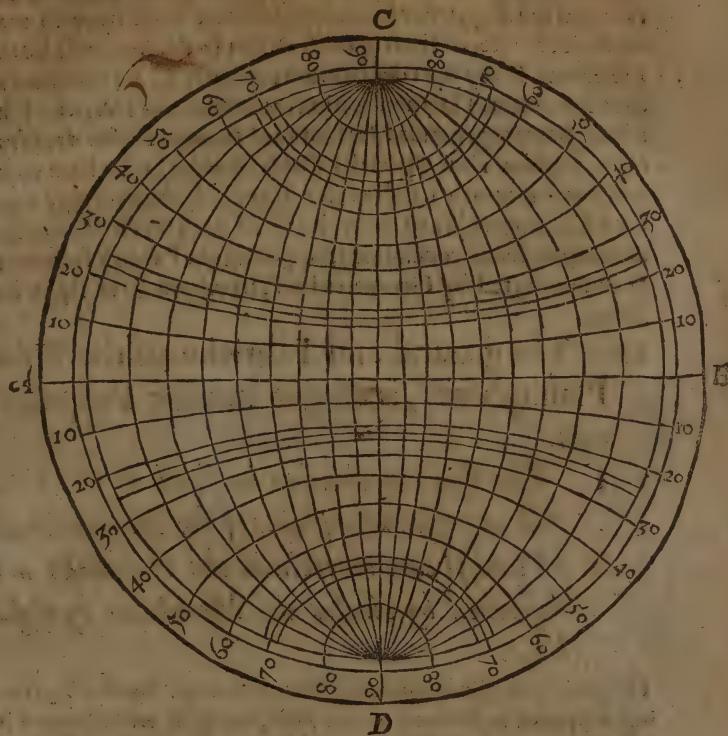
1. *The eye conceiued to be fixed on any point of the æquatour, will designe out vnto vs a Planisphære wherein all the circles are projected circularly, except the æquatour & that Meridian which passeth by the said point.*

This may easily be shewne out of Opticke principles, we will suppose for example sake the eye to bee placed in some point of the æquatour: which shall bee 90 degrees of longitude from the α quinociaill point: which kinde of projection wee haue in many of our common Geographicall Mappes of the earth. In this manner of sight, if the terrestriall Hemisphære, which may onely bee comprehended by it, be distinguished by his Parallels and Meridians or-

dered and ranged by distances of equall Arches in such number as we please: It is most certaine that the Eye, seeing distinctly and separatly every one of these Meridians and Parallels, will forme to it selfe so many visuall Pyramides, called by Geometricians Cones, which cones by this meanes will be Scalenes, & will haue for their Bases those Meridians and Parallels, the tops whereof will meet together in the same point and eye of the beholder, which according to this supposition is the Pole of the Meridian, which passeth by the Canaries, called the first Meridian, and representing vnto vs the \textcircumflex Equinoctiall colure. Now because these lines are cut by the plaine of the Meridian passing by the Canaries, it followes out of the same grounds, that their commona sections, and that of the Meridian are the portions of circumferences, which represent vnto vs in this Plaine the Meridians and Parallels seeñe in this maner of sight. Notwithstanding that which is vnder the 90 degree of longitude, as likewise the \textcircumflex Equatour, cannot (according to Opticke demonstration) be seeñe, but as right lines cutting one the other at Right Angles in the Center of the same Meridian of the Canaries: The Theory being expressed we will in the next proposition shew the manner of projection.

2. *How to describe the Meridians and Parallels in the \textcircumflex Equinoctiall Planisphere.*

To shew the practise of this Theoreme, let there bee drawne a circle A C B D, as you see in this figure diuided by two Diameters cutting on the other at right Angles, in the Center into foure Quadrants, or equall parts; whereof each one is againe to be divided into 90 degrees. In this the line A B is imagined to expresse the halfe of the Equatour, as the line C D of the Meridian; in which the two points C and D designe out the two Poles. Let a rule be drawne from the Pole C by euery tenth or fist degrees of the halfe circle A D B, and let every section of the Equatour and the rule be precisely noted. In like sort from the point B let the Rule be moued by euery fist and tenth Degree of the semicircle C A D, and let every severall Intersektion of the rule and the Meridian C D be precisely noted. Then placing



cing one foot of the compasse in the line CD (which must bee drawne out longer, because in it the Centers of the Parallels must be found out) let the other be moued in order to euery intersection of the Meridian noted out: and let so many circles be drawne as intersections, which circles will bee so many Parallels. The finding out of the Centers where the stedfast foot of the compasse ought to be fixed in drawing of each circle, is a matter appertaining to Geometricians: who haue taught a way to bring any three points giuen into a circle, and to finde the Center from which it is described. Hauing thus described the Parallels, we must proceed on to drawe the Meridians in this manner: let the one foot of the compasse be placed in the

line A B, from which as the Center by every Intersection of the rule, and the \textcircumflex equatour forenoted, let there be drawne so many circles as intersections; which circles so drawne will be the Meridians. If any man desire more curiously to be informed in the Geometricall Demonstrations, whereon this Fabrick of the Planispheare is grounded, let him read *Gemma Frisius de Astro-labio*, *Stifelius*: but especially *Guido Ubaldus*, who hath copiously and accurately handled this subiect. Enough it may seem for a Cosmographer to shew the vse of it, as we shall hereafter in Geographicall conclusions, supposing the Fabrick sufficiently demonstrated by Geometricians, to whom it of right belongs.

10 The ground and Fabricke of the Polar Planispheare, is taught in these Propositions.

1 The Eye conceiued to be fixed on the Pole will expresse in the plaine of the \textcircumflex equinoctiall a Planispheare wherein all the Parallelis are described by circles and Meridians by right lines.

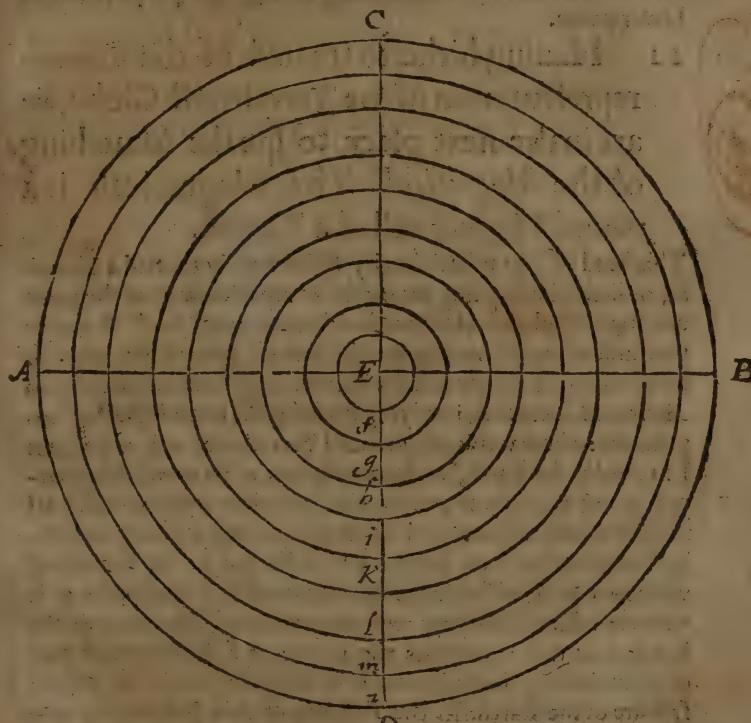
This may likewise be optically demonstrated: For the Eye being supposed to be fixed on the Pole, the sight will forme to it selfe so many visuall Cones as there are Parallelis described in the Spheare. These Cones being supposed \textcircumflex equally to be cut by the plaine of the \textcircumflex equatour, will haue for their Bases the said Parallel circles represented in the plaine of the \textcircumflex equatour, as so many absolute circles; whereof the \textcircumflex equatour will be the greatest, and comprehending within it all the rest. Likewise the Meridians in this kinde of sight are supposed to terminate the sides of these Cones, and therefore according to the Optickes ought to be right lines.

2 How to describe the Parallelis and Meridi-

ans

ans in the Polar Planisphere.

This projection is easiest of all, as shall appear by this Diagram. Let there be described a circle from the Center E which shall be A C B D: Let this circle be by two Diameters A B & B C divided into four quadrants: each of which may againe



be divided into 90 parts: every fist or tenth of these 90 parts being first marked out, so many Diameters may be drawne from either side to the opposite part by the Center E: which Diameters so drawne will serue for the Meridians. Then let any one of these lines be diuided into 9 parts, and diligently marked out, as the Semidiameter E D by F G H I K L M N: by

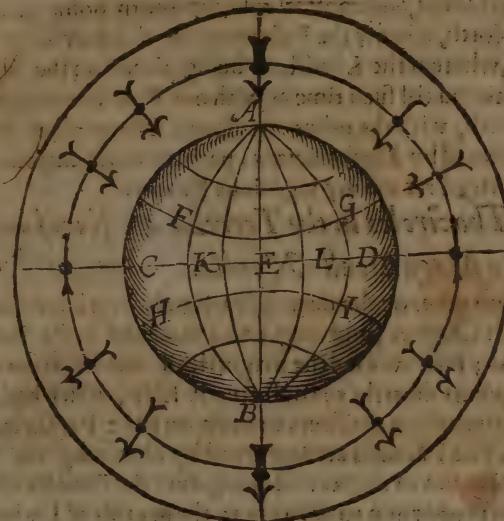
all which marks from the Center E, let there be drawne so many circles. These circles so described will be the true Parallels: This kinde of projection, though more vnusuall, yet wants not his speciall vse in describing the parts of the earth neare the Pole, which in our ordinary kinde of Tables projected after the other manner, cannot suffer so large and proportionall a Description.

II Hauing hitherto treated of the Common representation of the Terrestriall Globe, we are in the next place to speake something of the *Magneticall*. The *Magneticall* is a round Magnet called a *Terrella*.

This kind of spheare hath bin by *Gilbert* aptly termed a *Terrella*, or little Earth, being the model & representatio of the great and massie Spheare of the earth whereon wee dwell. Betwixt this kind of representation and the former, great difference may be obserued. First because the former is grounded merely on *Artificiall Imitation*, implying nothing else but a *Reffelt* or application: whereas this *magneticall Terrella* not only represents Externally the Earth, but Internally out of its owne *Magneticall* nature and vigour, eminently containes and expresses all those motions and *magneticall* vertues, which we haue formerly shewed to be in the Earth. 2 It skills not in the former of what *materiall substance* the Spheare consists, so the parts of it answere in due symmetry and proportion to the parts of the Earth; but this represents the whole as a *Homogeneall* part communicating the same nature & substance with the whole spheare of the Earth: In the *Fabrick* of this Instrument wee must consider, 1. the *Matter*: 2 the *Forme*: The matter (as we haue already intimated) is a *Magneticall* substance which ought to be chosen out of a most eminent Mine, hauing all his parts pure and ynmixt, as possible we can finde in any Magnet. For though all Loadstones haue the same inclination, yet in many the vigour is so weake, or at least so hindred by the mixture of

some

some Heterogeneall matter, that they will not so well and sensibly performe their office. The forme of it is the roundnesse and politure, wherein Art should shew as much exactnesse as she can; such a Spheare may well be expressed in this Figure, whereof we had formerly occasion to make vse: wherein the footsteps of this Magneticall vigour are sensibly expressed, no otherwise then in the great Body of the Earth.



12. In this Magneticall Terrella two things are chiefly to be noted, 1 the inuentio of the Poles, 2 of the Parallels & Meridians: both which shall be taught in these Propositions.

1 To finde out the Poles in the Magneticall Terrella.

To performe this conclusion many artificiall waies haue beene invented, 1 By the *Inclinatorie* Needle: for being evenly hung in such fort vpon the Terrella, as may be seen in the former figure it will according to divers points diuersly respect the Terrella

in his site: wheresoever then we shall finde it to fall perpendicularly at right angles, we may assure our selues that that very point is the Pole: which being once knowne, it will be easie to finde the opposite Pole, either the same way, or by measuring. 2 By the Veyne or Mine of the Loadstone: for (as wee haue shewed in our fourth Chapter of this Treatise) that part which was situated towards the North, will afterwards direct it selfe Southward, and contrariwise, the South point will respect the North, whence the Poles may be discouered. 3 By a little boat, wherein the Loadstone being placed on the water, will moue round till such time as with one Pole hee may point out the North, with the other the South. Many other waies may be inuented by Mechanicians, perhaps more curious, to whose industry I referre my ingenious Reader.

2. *The circles in the Terrella are found out by the Magneticall Needle.*

This needs no other ocular demonstration then we haue taught in the fourth Chapter, and may bee conceaued in the former Diagramme; First wee see the magneticall needle according to diuerse points diuersly to conforme it selfe, which hath given way to ingenious artificers to finde out the Parallels and Meridians. The Parallels are found out by obseruing the Angles of declination of the Neede, hung ouer the Terrella which are found in proportion to answere to the degrees of Latitude; which Dr Ridley in his Magneticall Treatise hath industriously calculated, as I haue here inserted, to saue others a new labour of calculation. The Meridians are more easily found by hanging any directory wier or needle ouer the Terrella, one end of which pointing towards the North, and the other towards the South, will discouer the Meridian line.

A Table

C H A P. VIII.

Of the measure of the Terrestriall Globe

Hitherto haue we handled the Terrestriall Globe primarily: in such proprieties as absolutely agree vnto its nature. In the second place wee are to handle such as secondarily arise out of the former. Here we are to handle two chiefe points. 1 The Measure. 2 The Distinction.

2 The measure is that by which we find out the quantity of the whole Earth.

Good reason haue we to call this the *Secondary* part of *Geography*; forasmuch as these accidents and proprieties we here consider, arise altogether out of the former. In the former Treatise we haue diuided the *Naturall* Spheare of the Earth, from the *Artificiall*: But in this part, for avoiding of tedious repetitions of the same things, we haue ioyned them together: For howsoeuer the measuring and distinctions of the Earth be truly grounded on the nature of the earth it selfe; yet can it not be well expressed & taught without the materiall Instruments: we haue therefore thought good to consider the measure of the earth, before we come vnto the Distinction, because it is more simple and vncompound, depending on the lineaments & measure of one circle: whereas the Distinction necessarily requires the conjunction and combination of diuerse circles, as *Meridians* and *Parallels* compared one with the other, as shall bee taught hereafter. Whether the great masse of the earth can be measured, or no, seemes a matter not agreed on by all; Some haue held an opinion that it cannot be measured, in regard of

the infinite magnitude wherewith they thought it endowed: which opinion seemes derived from some of the *Platonicks*, who ascribing to the Earth another figure besides the *Sphericall*, haue cast themselues vpon vncertainties, and being not able to reduce the Quantity of the Earth according to their owne grounds to any certaine measure, haue denied it to bee measurable: But the ground of this opinion we haue taken away before, in prouing the earth to be of a true Sphericall nature, and therefore circumscribed in certaine bounds apt to be measured. Another conceit more absurd then the former, is not only of the common people, whose condition might excuse their ignorance, but of such as would bee esteemed learned; who contend, that the greatnessse of the earth cannot be measured: the onely reasons they can alleadge for themselues are, 1 That a great part of the earth is vnaccessible by reason of steepe rocks, high mountaines, spacious & thick woods, moorth fogges, and such like impediments. 2 That the parts of it are for the most part vneuen, and subiect to no regular figure, without the which no measure can be exact. The first cauill is of no moment; because whereas we affirme that the Earth by man may be measured, we hold it not necessary that it should be trauersed ouer by iournies or voyages. Forasmuch as to the finding out of the Quantity of the whole Terrestriall Spheare, it may seeme sufficient to know the measure and proportion of any little part in respect of the Heauens. As for example, what number of *Miles*, *Leagues*, or *Furlongs* answer to any *degree* or *degrees* in the Heauens: wherefore we suppose the Earth to be measured ouer not with our feet, but with our wirs, which may by Mathematicall rules bee taught to march forward where our legges fayle vs: The second obiection only prooves thus much, that the Earth partaking of so many vnequal parts & irregular formes, cannot in the measuring admit of so much exactnesse, as if it were endowed with one vuniforme face: yet it is exact enough to content a *Cosmographer*, who meauureth not by feet and inches, but by leagues and miles, in which wee little regard such a needlesse curiositie.

I. The comon measure by which the quātity
of the earth is known, are *Miles, & Furlongs.*

Here is to be noted that such instruments as serue for measuring are of two sorts, either greater or lesser; the smaller are of diuerse sorts, as a *Graine, Inch, Foot, Pearch, Pole*, and such like. Some of these howsoeuer sometime vsfull in *Topographie*, can haue little or no vse at all in the vast greatnesse of the whole Earth. Wherefore the *Geographer* seldome descends so lowe, but takes notice of greater measures, such as are *Miles & Furlongs*: where we may obserue by the way, that the vfull measuring amongst the *Grecians* was by *Stadia* or furlongs, amongst many of the *Latines* by *miles*: vnder which wee also comprehend *Leagues*: these miles are diuersly varied, according to the diversity of Countries, so that in some places they are esteemed longer, in other shorter: which differences may be learned out of this ensuing Table.

The instru- ments of measuring the Earth are	1 Mile which is either	1 Furlong containing 125 Geometricall paces or 625 feet.
		1 Proper containing 8 Furlongs or 1000 paces.
2 Impro- per, which is either	1 League which is ei- ther	1 Old, containing 12 Furlongs.
		2 Newer containing 16 Furlongs.
2 German mile which is either the	3 Common of 24 Fur- longs,	3 Common of 24 Fur- longs,
		4 Greatest containing 5000 paces which is called the <i>Suevian</i> , or <i>Helvetian</i> mile.

Howsoeuer this Distinction of miles may be many waies profitable, especially in the Topographicall part, yet shal we seldome make vse of any other then the common *Germane* mile, or the common *Italian* mile: To which as the most knowne, the rest may easily be reduced.

- 3 The object here proposed to be measured is the Spheare of the Earth. The Dimensions according to which it is measured, are either *Simple* or *Compound*.
- 4 The simple is twofold, either the *Perimeter*, or the *Diameter*. The *Perimeter* otherwise called the *circumference*, is a great circle measuring the Earth round about.
- 5 The *Invention* of the *Perimeter* of the Earth depends on these following Propositions.

1 *If two or more circles be drawne about the same Center, and from the Center to the Circumference be drawne two right lines; The Arches of all the Circles comprehended within the said right lines will be like and proportionall one to the other.*

This Proposition being merely Geometricall, is taken here as a ground without farther demonstration: whereof if any man doubt, he may haue recourse to *Clavius* Commentaries vpon *Iohannes de Sacrobosco*. This principle granted will beget these two Consequences.

- 1 *As one degree is to the number of correspondent miles, or furlongs, so all the degrees of the circles to the number of miles or Furlongs measuring the quantitie of the Perimeter of the Earth.*
- 2 *Wherefore one degree or portion of the Circle*

cle being knowne by his number of miles or furlongs, the whole Circumference may bee found out.

The reason of this consequence every *Arithmetician* can easily shew out of the *Golden Rule*: The chiefe point then of the invention consists in finding out the proportion of any portion, as a degree, halfe degree, or the like; to the number of miles or Furlongs answerable thereto; for which purpose many skillfull *Mathematicians* haue invented many excellent waies of great vse and delight.

1. *By the elevation of the Pole, or observation of an Eclipse, or some knowne Starre, the circuit of the Earth may be found out.*

By the Elevation of the Pole it is performed after this maner: let there be obserued two *Citties*, or other notable *Land marks* placed iust North and South vnder the same Meridian. In these two *Citties*, or markes, let the Eleuation of the Pole be exactly noted. Then subtract the Eleuation of the Southerne *Cittie* which is lesser, out of the Northerne, which is greater: the residue containes the distance of these places in degrees; which being experimentally knowne by Miles, Halfe-miles, Furlongs or such like measures, will shew the true proportion betwixt a degree, and his number of miles: which being againe multiplied by 360, will shew the whole circumference of the Earth. For example sake, we will take two famous Cities of *England*, *Oxford* and *Yorke*; which are situated, it not exactly, yet very neere the same Meridian. The eleuation of the Pole here with vs at *Oxford* is 51 degrees and 30 minutes; at *Yorke* it is 54 degrees 30 minutes, or neere there about: subtract the lesser from the greater, the distance betwixt *Oxford* and *Yorke* will be three degrees; which distance experimentally knowne in miles, will shew the proportion: which we shall finde to bee, (abating somewhat in regard of the crookednesse of the way,) about 180, answering to three degrees of the Meridian.

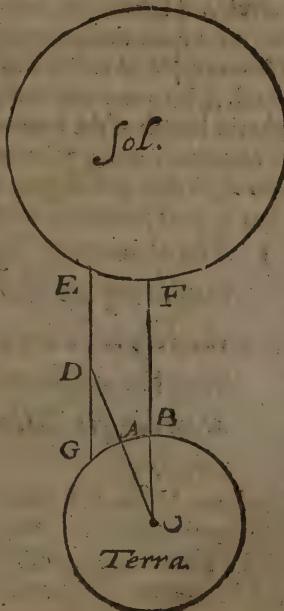
X. 3 wherefore.

wherefore to one degree will answere 60 Miles, which being multiplied by 360, the whole circle will produce 21600, the measure of the whole Earth. The like may be performed by an Eclipse in two Citties lying vnder the $\text{\AE}quinoctiall$ circle: two land-markes being once noted out, lying vnder the $\text{\AE}quinoctiall$, let there bee obserued in both the same Eclipse of the Moone, especially in the beginning: Now it being certainly found out how many howres the Eclipse beganne in the one place before the other, we must resolute their howres into degrees, which is easily done: forasmuch as to every hour answeres 15 degrees in the Sunnes Diurnall motion, according to Astronomers. Now the distance betweene these two Citties or markes (being supposed first experimentally to bee knowne, will easily shew the correspondency betwixt the Degrees and miles, which is here sought. Another way is taught by *Possidonius*, as easie as the former, which is performed by some noted fixt Starre, as *Oculus Tauri*, *Arcturus*, *Spica Virginis*, or any other; let there bee obserued vnder the same Meridian in the Earth two places, whose distance is experimentally knowne: in both these places let the Meridian altitude of the Starre be fully and perfectly obserued: The difference of these two Altitudes will be the number of degrees betwixt these two places: whence wee may obserue how many miles, or other parts answere to the number of these degrees betwixt these two places. This way by *Clavius* is preferred before the former; forasmuch as it requires not in any place the knowledge of the Elevation of the Pole, which in any place cannot be certainly knowne, without long and diligent search, and obseruation: As for Geographicall Tables, they are not alwaies and at all times to be had, at least worthy credit.

2 *By the obseruation of the Noone-shadowes
the measure of the Earth may be found out.*

This way was inuented by *Eratosthenes* a famous Mathematician: who by obseruation of the Noone-shadowes, obserued at the sametime at two diuerse places, situate vnder the same Meridian, found out the circumference of the Earth. The pla-

ces which he chose for this purpose were *Siene*, and *Alexandria*, situated vnder the same Meridian: the one inclining to the South, the other to the North. The Distance betwixt these two places is supposed to be knowne, whence hee proceeded in this manner: First he erected a *Gnomon* at right Angles on the plaine of the Horizon: when the Sunne was in the beginning of *Cancer* called the *Solstice*, from which he imagined two *Rayes* or *Beames* to be cast at Noone: the one passing by *Siene* the most Southerne part, the other by *Alexandria* the most Northerne: so that at *Siene*, the Sunne being then in the *Solstice* passed into the *Center* of the world: the place being supposed to haue beene situate vnder the *Tropicke*: The other passed by the *Vertex* of the said *Gnomon*: whence by proportion of the shadow to the *Gnomon* by a *Geometricall* kinde of working he found out the space betweene *Alexandria*, and *Siene*: which demonstration, for more evidence we will here set down: Let there bee in the Earth described a cirele passing by *Alexandria* and *Siene*; in which let A be the place where *Alexandria* stands: B the place of *Siene*: the *Gnomon* or *Style* erected at *Alexandria*, AD, The Sun-beame carried to the *Center* of the world at *Siene* EB C, The Sun-beame passing by the *Vertex*, or toppe of the *Gnomon* seated at *Alexandria* ED G, casting his shadow AG toward the North: let the *Gnomon* bee conceaued to be prolonged vnto the *Center* C: Now forasmuch as in the *Triangle* ADG, the Arch AG, without any sensible difference may bee taken for a Right line, having an infen-



sible magnitude in regard of the whole Earth: and the Angle A is a right angle, and the two sides A D, and A G knowne: the former by supposition, being a *Gnomon* taken at our pleasure; the latter by any measure, or at least by the knowne proportion of the shadow to the *Gnomon*, according to the Doctrine of Triangles: the Angle A D G will bee knowne; For whereas the sides A D, and A G are supposed to be knowne, their *Quadrats* also will be knowne, which being æquall to the square made of D G, by the 47 proposition of the 1 of *Euclid*, the right side D G will easily bee knowne: out of these grounds by the doctrine of the *Sines* and *Tangents* is easily found out the Angle A D G, and by consequence the alternate Angle A C B, which by the 27 of the first of *Euclid* is equall vnto it: forasmuch as the two *Radij* F B C and E D G may be supposed to be Parallels in so small a distance as *Alexandria* and *Sicene* compared with the *Sunne*: the Angle being knowne the *Arch* A B subtended to the Angle C, will also be knowne, which is the space intercepted betwixt *Sicene* and *Alexandria*; and for example sake: if *Eratosthenes* (as some write) found out the Arch A B, to containe in degrees 85, and experience had taught the length of the Journey betwixt these two Citties to haue contained 618 $\frac{1}{2}$ Furlongs: It would appeare by the *Golden Rule* that 360 degrees containing the whole circuit of the Earth must proportionally answere 252000 Furlongs.

I. *The opinions of Cosmographers concerning the measure of the Earth, are diverse: which is chiefly to be imputed to their error in observing the distances of places experimentally according to Miles, Furlongs, or such like measures.*

How many Authors of great name and estimation haue differed amongst themselves, every man may enforme himselfe out of this Table here inserted. These differences we finde diversly related: but of all others, which Authors haue set forth,

Authors	Furlongs	Miles.
Strabo and Hipparchus	252000	31500
Eratosthenes.	250000	31250
Possidonius & the ancient Arabians.	240000	30000
Ptolomie.	180000	22500
The later Arabians	204000	25500
Italians and Germans.	172800	21600

I preferre the judgement of Mr *Robert Hues*; Forasmuch as it is not grounded on common tradition, but industriously by himselfe derived out of the Ancients by diligent search and examination, as by one, whose judgement being armed as well with skill in the language, as the knowledge of antiquity, scornes to be iniured by translation. What should be the cause of these differences, is a matter which hath staggered curious searchers into Antiquities more then the former. Every opinion being supported with the names and authorities of such renowned Authors, might challenge a pitch aboue the measure of my Decision: only I may not be thought ouer presumptu-

ous to coniecture where I cannot define, especially hauing so good a guid as my forenamed Author, to tread out the way before me. Wherefore supposing as a ground, these Authors so much differing about the measure of the earth, to haue been in some sort led by reason. The differences must needs arise out of one of these causes: either the error or negligence of the obseruers, in trusting too much to others relations without any farther search, or else the defect in the Mathematicall grounds out of which they deriued their demonstration; or the diuersity of measures vsed in this worke: or finally, from the misapplication of these measures to the distances; whence may arise some error out of the experimental measuring of places in the earth. In the first place it may perhaps bee doubted whether *Aristotle* defining the measure of the Earth to be 400000 fur- longs, were not deceaued by relations: forasmuch as hee avoucheth it, from the Mathematicians of his times, whose authori- ty and credit for ought we knowe, deserues as well to be for- gotten as their names. But this answere might seem too sharp in the other: forasmuch as we finde them registered for Masters in their science, and such as could not easily bee cosened by o- thers impostures. Neither can we imagine the second to bee any cause of their error for the same reason: because the waies these Mathematicians vsed in finding out the circuit of the earth, are by writers of good credit commended to posterite, as warrantably grounded on certaine demonstrations, being no other then what we haue shewed, before, which ad- mit of no Parallogisme. In the third place we ought to examin whether the diuersity of opinion concerning this matter pro- ceeded from diversite of the measures which were vsed in this worke. *Nonnius* and *Pencerus* would needs perswade, that the Furlongs whereby they measured the earth were not the same: *Maurolycus* and *Xilander* talke of diuerse kindes of paces: *Maurolycus* labours to reconcile both, but without effect. First whereas they would haue diuerse kinde of paces, it cannot bee denied: but in the meane time we cannot learne that the *Grecians* euer measured their Furlongs by *Paces*, but either by *Feet*, or *Faddomes*. A Faddome which the *Greekes* call *egula* is the measure

measure of the extension of the hands together with the breast betwixt, containing six feet: which is a kinde of measuring well knowne vnto our Marriners, in sounding the depth of the Sea. This measure notwithstanding is by many translated a Pace: by what reasoun, let any man judge. *Xilander* in translating *Strabo* renders it an Ell: Secondly for a Furlong it containes according to *Herodotus* an ancient Grecian writer 600 Feet: which is also testified by *Suidas*, being much later. A Furlong containes 100 Faddomes; every Faddome foure Cubits. A Cubit, according to *Horon*, a Foot and halfe, or 24 Digits. Now for the varietie of Furlongs, it is true that *Censorinus* makes three kindes. For either it is called the *Italian* consisting of 625 Feet, which is of most regard in measuring the Earth; or the *Olympian* of 600 Feet; or the *Pythian* containing 1000 Feet. But to let passe this latter, we shall finde by serious consideration, that the *Italian* and *Olympian* Furlongs differ only in name, and are indeed the same. For the *Italian* containing 625 Roman Feet (according to *Pliny* in his second booke) is equall to the *Olympian*, hauing 600 Grecian Feet. For a Foot with the *Gracians* exceeds the *Roman* Foot by a twenty fourth part: as much as is the difference betwixt 600 and 625. Hence we see how little certainty can be expected of such as goe about to reconcile these opinions out of the various vse and acceptation of the measures. The most probable assertion then is, that the errore was grounded on this, that the distances of places, mentioned by the foresaid Authors, were not by themselues exactly measured, but taken vp vpon trust on the relation of trauellers, wherein they might easily be mistaken. For instance we will take *Eratosthenes* and *Possidonius*, as of greatest credit, who are notwithstanding taxed for many errores in their experimentall observations: whereas it is cleere that *Ptolomy* grounded his opinion on the distance of the places, exactly measured, as is witnessed by his designation of the Latitude of the earth so farre as it was discouered and knowne. *Eratosthenes*, for mistaking in the measure of distances, is much taxed by *Hipparchus*, as wee finde in *Strabo*: For betwixt *Alexandria* and *Carthage*, he reckons aboue 13 thousand furlongs, whereas by a more diligent enquiry

there are found to be but 9 thousand. Likewise *Possidonus* is knowne to be mistaken, in that hee made the Distance betwixt *Rhodes* and *Alexandria* to be 5000 Furlongs, whereas out of the relation of Marriners, some haue made it 4000, some 5000, as it is witnessed by *Eratosthenes* in *Straba*; who notwithstanding, sayes that he found by Instruments that it was not aboue 3750; and *Strabo* would haue it somewhat lesse, as 3640. *Manarlycus*, going about to defend *Possidonus* against *Ptolomy*, brings nothing but frivolous reasons vnworthy so good auauthor. Out of all which hath beene spoken, our former Corollary will be manifest, that the diuersity of opinions concerning the circumference of the Earth, arose from the experimentall mistake in the distances of places, where they trusted to other mens relations, rather then their owne knowledge.

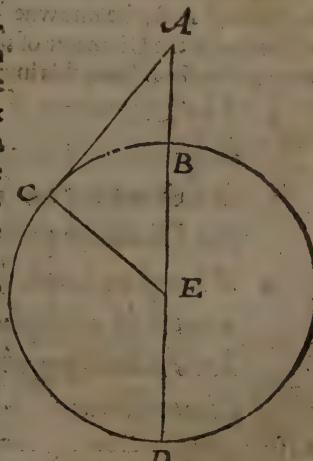
6. The Diameter is a right line passing by the Center of the Earth from one side to the other, and measuring the thicknesse of it: the invention of which depends on these Rules.

1. As 22 is to 7 so is the circumference of a circle to the Diameter: wherefore the circumference of the Earth multiplied by 7, and diuided by 22 will produce the Diameter.

The exact proportion betwixt the Circumference of a circle, and the Diameter being the ground of the Quadrature of a circle, is a matter which hath set aworke the greatest witts of the world: hauing notwithstanding as yet by no man been brought to discouery, insomuch as *Pitiscus*, and other good Mathematicians, might well doubt whether euer it would come to light. Neuerthelesse, where exactnesse canet be found, wee must come as neere as we can. The neerest proportion in numbers which any could yet light on, is as 22 to 7, which in so great & massie a body, as the Earth may passe without any sensible or explicable erour. Supposing then out of our precedent Suppositions the whole

whole circuit of the Earth to be 21600 Italian miles (which is the common opinion now receaved) I multiply according to the golden Rule 21600 by 7, whence will arise 151200, which being diuided by 22 the Quotient will render 6872 $\frac{8}{11}$ which is the Diameter or thickaesse of the Earth: some lesse curious are content to take only the third part of the circumference for the Diameter, which will be 7200, which account is lesse exact, yet sufficient for an ordinary Cosmographer: forasmuch as 328 miles, which is the difference, is of no great moment in the measure of the whole Earth.

2. By the knowne height of some mountaine without the knowledge of the circumference of the Earth, the Diameter may be found out.



traordinarily litle, if compared with the whole Earth. These grounds thus laid, we must proceed by a Geometrical maner of argumentation in this sort. Here are to bee obserued four right lines: whereof the first is A B, the heighth of the mountaine obserued: the second is the visual Ray A C: the third A D consisting of the height of the mountaine, and the Diameter of the Earth. The fourth B C, the distance which is seene; for (as wee haue shewed) it may without feasible error bee taken for a right line. Now forasmuch as A B, B C are knowne, their Quadrates by the 47 proposition of the first of *Euclide*, will also be knowne; which being æquall to the square of A C, the square of the right line A C will likewise be knowne. But the square of the right line A C, sith it toucheth the circle, will bee æquall to a Right Angle Figure contained vnder D A, A B, wherefore the right angle so conceaued will be knowne. But A B is the knowne heighth of the mountaine, wherefore the right line A D will easily be knowne; if we diuide the knowne right Angle contained vnder A B, A D: by the right line A B: for the Quotient will give the right line A D; from which if we subduct A B, the knowne heighth of the mountaine: then will remaine the Diameter of the Earth B D, which was here to be performed: from this inuention will arise this Corollary.

1. *The Diameter of the Earth first supposed to be knowne the circumference may be found out in this manner: as 7 is in proportiō to 22, so is the Diameter to the Circumference.*

2. *Wherefore let the knowne number of the Diameter be multiplied by 22, and the Product be devide by 7, the quotient will give the Circumference.*

As for example according to our former instance: Let vs suppose the Diameter of the Earth to bee 6872 $\frac{1}{2}$; this number being multiplied by 22, will produce 15120, which product diuided

deuided by 7, we shall finde in the Quotient 21600, which is the circumference of the Earth.

- 7 The compound dimensions, according to which the Spheare of the Earth is proposed to be measured, are either the *Superficies* or the *Solidity*.
- 8 The *Superficies* is againe twofold, either *Plaine* or *Convexe*: the *Plaine* is the space included in the Perimeter.
- 9 The *plaine Superficies* may bee found out two waies: either by the *Circumference*, or the *Diameter*: both which waies are taught in these Rules.

1. *If the whole circumference be multiplied in it selfe, and the product bee devided by 12 $\frac{4}{7}$, the quotient will shew the Superficies included in the circle.*

As in the former example wee will take the *Circumference* of the Earth to be 21600 *Italian miles*: let this number be multiplied in it selfe, and the product thereof divided by $12 \frac{4}{7}$, the Quotient will amount vnto 9270180, which is the *plaine superficies* of the Earth.

2. *If the Semi-Diameter of a circle bee multiplied by the halfe part of the Circumferēce: there will arise the measure of the Plaine Superficies contained in the Circumference.*

The reason hereof is shewed by *Clavins* in his *Tract de l'operimetris Prop. 4.* where is demonstrated, that a Right Angle figure

figure comprehended of the *Semi-Diameter* of any circle, and the halfe of the Circumference will be æquall to the Circle it selfe, of whose parts it is comprehended.

10 So much concerning the *Plaine Superficies*: the knowledge and inuention of the *Convexe*, may bee performed two vvaies: either by the *Diameter* and *Circumference*; or else by the *Space* contained within the *Circumference*, according to these *Propositions*.

1 If the *Circumference* and *Diameter* be multiplied the one into the other, the product will shew the number of square miles in the face of the *Terrestriall Globe*.

As for example, let the *Diameter* of the Earth containing according to the common account 80 11 1/2 furlongs, be multiplied by the whole *Circumference*, which is 25 200 3, there will arise the *Convexe Superficies* of the whole earthly *Spheare* which is 20205 818 181 1/2.

2 If the *Space* contained in the greatest circle in the *Spheare* be multiplied by 4, there will be produced the whole *Convexe Superficies* of the *Spheare*.

How to finde out the *space* or *plaine Superficies*, is a matter taught before: which being once found is easily multiplied by 4, and so will give vs the number sought.

11 The last and greatest compound Dimension, according to which the Earth is measured is the *Solidity*, consisting of *Length*, Breadth,

Breadth, and Heighth, or Thicknesse: This may be found out two waies: either by the Diameter, and Convex Superficies, first supposed to be knowne: or by the knowledge of a great circle vwithout supposing the Superficies to be first knowne: both waies shalbe expressed in these Propositions.

1 If the Semidiameter of the Spheare be multiplied into the third part of the Convex Superficies of the said Spheare, there will arise the whole Solidity of the Earth.

This is demonstrated by *Geometricians*: For a solide Rectangle comprehended of the Semidiameter of the Spheare, and the third part of the Convex Superficies of it, will be equall to the Spheare it selfe. As for example, if the Semidiameter of the earth containing 4009¹¹ Furlongs bee multiplied by the third part of the Convexe Superficies containing, to wit, 67352727³, there will arise the solidity of the earth, which will containe 270023206611570³ Cubick Furlongs. That is the solidity of the earth will comprehend so many Cubes, containing every side so many Furlongs, as there are unities in the said number: For the *Area* or spaces comprehended of Solide figures are measured by the Cubes of those lines, by whose squares the Convexe Superficies of those lines are measured.

2 If the greatest circle be multiplied by $\frac{2}{3}$ of the whole Diameter: the product will shew the solidity of the Spheare.

This way is also demonstrated by *Clavius* in the same tract of measuring Magnitudes. It may Arithmetically be deduced in this sort. If any Spheare whatsocuer hath a Diameter of 14 Palmes, and should be multiplied by $\frac{3}{7}$, the circumference of

the greatest circle containing it will be found to be 44; whose halfe being 22, if it be multiplied into the Semidiameter 7, there will arise the Superficies of the greatest circle 54, which number if we multiply by two third parts of the Diameter: that is by $9\frac{1}{3}$ there will bee produced the solidity of the said Spheare, to wit, consisting of $143\frac{7}{3}$ Cubick palmes. In the like sort may we worke by miles or furlongs in measuring the whole terrestriall Globe, which is a more convenient measure for the massie Globe of the Earth.

CHAP. IX.

Of the Zones, Climates, and Parallelles.

- 1 **O**F the Measure of the Earth vve haue treated in our former Chapter. In the next place vve must speak of the Distinction of the Terrestriall Spheare, vvhich is either in regard of *Spaces* or *Distances*.
- 2 Spaces are portions in the Spheare bounded by the Parallel circles: such as are the *Zones, Climats, and Parallelles.*
- 3 These are againe considered tvvo vvaies; either in themselues, or else in their *Adjuncts* or *Inhabitants* belonging to them.
- 4 **A Zone** is a space included betwyx two lesser

lesser and named circles; or else betwixt a lesser circle and the Pole of the world.

Th: spaces into which the Terrestriall Spheare is diuided , are either Greater or Lesser. The Greater is a Hemisphære , which ariseth out of one only circle by it selfe, without the Cōbination of more. Such are chiefly of three sorts. The first is made by the Æquatour: which diuides the whole Globe into the north and the South Hemisphære. The second is of the Meridian, whose office it is to part the Earth into the Easterne and Westerne Hemisphares: The third of the Horizon, whi h diuides the Spheare into the upper and lower halves : But these parts arising (as I said) out of one only circle, are handled before with the circles themselues. In this place wee are to speake of such parts, as arise out of the Combination and respect of circles one with another. Such as are the Zones, Climats, and Parallelles. A Zone signifies as much as a girdle or band: because by it the spaces in the Earth are (as it were) with larger bands compassed about. The Grecians haue sometimes gien this name Zone to the Orbs of the Planets, as *Theon, Alexandrinus* in his Cōment on *Aratus*, in these words, Εξειδος ἐγράφεις ζεύς ον ζητάντος τοι ζοδιακῷ ἀν, τινὶ μὲν τοις οντος εἰσι Κρόνος: τι δὲ θεοὶ ον ζεύς. There are (faith he) in the Heauens seauen Zones not conterminate with the Zodiack, whereof the first is possessed by Saturne, the second by Jupiter &c. But this acceptation of the name is fare off from our purpose. The name Zone , as it is with vs in use, is by the Latine Poets rendered sometimes *Facia*, sometimes *Plaga*: both signifying one and the selte same thing; which is as much as a space comprehended within two Named and lesser Parallelles: or at least betwixt such a Parallel and the Pole it selfe: because, as we shall shew hereafter Zones are of two sorts: Thele Zones are in number five; which diuision hath beene familiar with our Latine Poets, as may appear by these verses of *Virgil*.

Quinq; tenent cœlum Zone, quarum una corusco

Semper Sôle rubens, & torrida semper ab Igne:

Quam circum extrema dextrâ levâq. trahuntur

*Carulea glacie concreta, atq; imbribus atris.
Has inter, Mediamq; dura Mortalibus agris
Munere concessa Divum, &c.*

Five Zones ingirt the Skies; whereof one fries
With fiery Sun-beames, and all scorched lies.
'Bout which the farthest off on either hand,
The blew-eyed Ice and brackish showres command.
'Twixt these two and the midſt the Gods doe giue
A wholsome place for wretched man to liue.
Which description of *Virgil* little differs from that we finde in
Ovid, in theſe Verſes.

— *Dua dextrâ cœlum totidemq; sinistrâ
Parte ſecant Zonæ: quinta eft ardentior illis:
Sic onus incluſum numero diſtinxit eodem
Eura Dei, totidemq; Plaga tellure premuntur.
Quarum qua Media eft non eft habitabilis aſtu:
Nix tegit, alta duas: totidem inter vitramq; locauit.
Temperiemq; dedit mixta cum Frigore Flama.*

Two Girdles on the right hand, on the left
As many cut the Skies: more hot's the firſt,
So God dividing with an æquall hand,
Into ſo many parcells cuts the land.
The midſt through heat affords no dwellers Eafe:
The deepe ſnow wraps vp two; but betwixt theſe
And the other Regions, are two places ſet,
Where froſts are mixt with fires, and cold with heat.

But becauſe this enumeration and deſcription of the Zonæ ſet
downe by the Poets, ſeemes too popular and generall, we will
more ſpecially diuide them according to the methode of our
times in this manner.

5. The Zonæ are either *Vntemperate*, or *Temperate*: the *Vntemperate* are againe twofold
either cold or hot.
6. The *Intemperate hot Zone* is the ſpace con-
tained

tained betwixt the two *Tropicke* circles of
Cancer and Capricorne.

How vnaptly these names of *Temperate* & *Untemperate* agree to the Zones, considered in their owne nature, we shall speake in our second part: yet because I thought it vnsit to vse other names then the Ancients, I will not coine new names. This Zone, or space included betwixt the two *Tropicke* circles, circum-scribes within it two great circles; whereof the one is the *Æquator* running iust in the midst, neither inclining to the North or South: The other is the *Ecliptick* obliquely crossing it and meeting the two *Tropicke* twice in a yeare, in the *Spring* and *Autumne*. The extent or breadth of this Zone then is a quall to the distance betwixt these two *Tropicke*, to wit, 47 degrees, which make 2820 miles; because from the *Æquator* to either *Tropicke* we account 23 degrees, which added and resolued into miles, will make the said summe: with in the compasse of this Zone are situate, the greatest part of *Afrike*, especially that of the *Abyssines* (which common opinion with little probability, would haue to be the Empire of *Prester Iohn*) also many Ilands as *Java*, *Summatra*, *Taprobana*, besides a great part of the South of *America* called *Peruana*: It was imagined by the Ancients, as *Aristotle*, *Pliny*, *Ptolomy*, and many other Philosophers, Poets, and Divines, that this Zone through extreme heat was altogether vnhabitable: for which cause they called it *Untemperate*: The reason of this conjecture was drawne from the situation of this part in regard of that of the heauens. For lying in the middle part of the world, the Sunne must of necessity cast his rayes perpendicular, that is to say at Right Angles. Now according to the grounds of Peripateticke Philosophy, the Idol of this age, the heat derived from the Sunne, ariseth from the reflexion of the Sun-beames against the surface of the Earth. Wherefore the heat was there conjectured to be greatest, where the reflexion was found to be greatest. But the greatest reflexion, according to all Mathematicians, must be in this *Torrid Zone*, where the Sunne darts forth his Rayes at right Angles, which reflect backe vpon themselves. Which

false conjecture was a long time continued by the exuberant descriptions of Poets, and defect of Navigation: hauing as yet scarce passed her infancy. But how farre these surmises come short of truth, we shall declare in our second part, to which we haue reserued those Physicall and Historicall discourses concerning the qualities and properties of the Earth.

7 The Intemperat cold Zones are those which are included betwixt the Polar circles and the Poles: whereof the one is *Northerne*, contained in the *Arctick* circle, the other *Southerne* in the *Antarctick*.

These two Zones are not made out of the combination of two circles, as the former: but by one circle with relation to the Pole. The greatnessse and extent of this Zone is about 23 degrees and a halfe: which resolued into *Italian* miles will produce 1380. The Northerne cold Zone containes in it *Greenland*, *Fineland*, and diverse other Northerne Regions, whereof some are partly discouered, and set out in our ordinary Maps, other some not yet detected. For the other Zone under the *Antarctick* Pole, it consists of the same greatnessse, as we know by the constitution of the *Globe*, hauing other such accidents correspondent as the Northerne, so farre forth as they respect the *Heauens*. For other matters, they lie hid in the vast Gulph of obscurity, this port hauing never yet (for ought I knowe) exposed her selfe to the discouery of the Christian world. Whether these two Zones be without habitation, by reason of intemperate cold, as the other hath beeene thought by reason of too much heat, we shall in due place examine.

8 The Temperate Zone is the space contained betwixt the *Tropicke* and the *Polar* circle: whereof the one is *Northerne* contained betwixt the *Tropicke* of *Cancer* & the *Arctick*

Arctick circle: the other Southerne comprehended betwixt the Tropicke of *Capricorne* and the *Antarctike* circle.

Why these Zones are termed Temperate, diuerse reasons are al'eaged. 1 Because the Sun-beames here are cast obliquely on the surface of the earth, and by consequence cannot produce so much heat, as in those places where they are darted perpendicularly, if we only consider the constitution and site of the heauens: For as we shall hereafter proue, this may sometimes be altered by the disposition of some particular place. 2 It may be called the Temperate Zone, because it seemes mixt of both extremes partaking in some measure the both qualities of heat and cold: the one from the Torrid, the other from the Frigid Zones. 3 Because in these Zones the distances betwixt Summer and Winter are very remarkable, having a middle difference of time betwixt them, as compounded of both extremes. These temperate Zones included betwixt the Tropicks and the Polar circles are twofold as the circles: The northerne temperate Zone comprehended of the Tropicke of *Cancer* and the *Articke* circle, containes in it the vpper and higher part of *Africks*, stretching euен to the mountaine *Atlas*. Moreover in it is placed all *Europe*, euен to the Northerne Ilands in the *Articke* Zone, and a great part also of *Aſia*: the other temperate Zone lying towards the South, is not so well knowne being farre distant from our habitation: and awaiting as yet the farther industry of our *English* and *Dutch* Nauigators. The breadth of this Zone, as the other containes about 43 degrees, which is the distance betwixt the Tropicke and the Polar circle, which multiplied by 60, will bee resolved into 2580 Italian miles.

1 *The Torrid Zone is the greatest of all: next are the two Temperate Zones: the cold Zones the least of all.*

The Torrid Zone is found to be greatest as well in regard of
longitude

longitude as latitude, and is diuided by the \textcircumflex equatour into two halves: the next are the Temperate; but the two cold Zones howsoeuer equal in Diameter to the Torrid, are notwithstanding least of all: where is to be noted that every Zone is of the same latitude from North to South, beginne where we wil, because it is contained betwixt two æquidistant circles: but all enjoy not the same longitude from East to West. For the parts of euery Zone by how much neerer they are to the \textcircumflex equatour, so much greater longitude will they haue: by how much neerer the Poles they are, so much the lesse longitude: forasmuch as the Parallells towards the Poles grow alwaies lesser and lesser. The inuention of the quantitie of the Zones before mentioned, may briefly thus be performed. The latitude of the torrid Zone is so much as the distance betwixt the Tropickes, which is Astronomically grounded on the greatest declination of the Sunne being doubled: This declination being by *Clavius* and others found to be 23 degrees 30 scrup. which being doubled will produce 47: which againe multiplied by 60, are resolued into miles, will amount to 2820: though the odde scruples of many Authors are neglected. The latitude of the cold Zones is also drawne from the greatest declination of the Sunne: For the distance of the Pole circles from the Pole it self is iust so much as the declination of the Ecliptick from the \textcircumflex equatour, to wit, of 23 degrees 30 scrup. to which answere according to the former Rule 1420 *Italian* miles. The inuention of the latitude of the temperate Zones depends from the subtraction of the distance of the Poles of the Ecliptick, from the \textcircumflex equatour; that is from the greatest declination of the Sun being doubled from the whole quadrant: in which subduction the residu will be 43, to which will answere 2580 *Italian* miles.

I. The Zone wherein any place is seated may bee knowne either by the Globe or Geographicall Table, or else by the Tables of Latitude.

By the Globe or yniversal Mappe wee may knowe it by the diligent

diligent obseruation of the fourte æquidistant circles. For if we finde it betwixt the two Tropicks, we may without doubt, thinke it to be in the Torrid Zone: It betwixt the Tropick circle and the Polar, it will be in the Temperate. If betwixt the Polar circle and the Pole it selfe, it must be in the cold zone. By the Tables of Latitude it may be found this waie: Seek the latitude of the places giuen in the Table, which if it be lesse then 23 degrees 30 scruples, the place is in the Torrid zone. If precisely it be so much in the Northerne Hemisphære, the place assigned is vnder the *Tropicke of Cancer*, which is the bound betwixt the *Torrid* and the beginning of the Northerne *Temperate* zone: But if it be in the Southerne Hemisphære, it will be vnder the *Tropicke of Capricorne*: which ends the *Torrid* zone, and beginnes the South *Temperate* zone: Every place hauing more Latirude then 23 degrees 30 scruples, yet lesse then 66 degrees 30 Minutes, is seated in the *Temperat* zone, either Northerne or Southerne as the places are in the Hemisphære. If the place be precisely of 66 Degrees 30 minuts, it will be iustly found to be vnder the Polar circle, either *Arcticke* or *Antarcticke*. Finally every place whose Latitude exceeds the number of 66 degrees 30 minuts, is seated in the cold zone either Southerne or Northerne. If it reach iust to 90 degrees, it will be iust vnder the Pole it selfe.

9 Of the distinctiō of the Terrestrial sphaere by Zones we haue spoken: we must in the next place deliuer the Distinction of the earth according to Climates.

10 A *Climate* is a space of Earth contained betwixt two *Parallells* distant from the *Æquator* towards either Pole.

Climates are so called because of their *Declination* from the *Æquator*; forasmuch as they are to be accounted as so many scales of ascents to or from the *Æquator*. Some haue defined it from the yle which is chiefly to distinguish the longest

time of the Artificiall daie: because at the point of euery climate truely taken, the longest day is varied halfe an houre: although this account agree not altogether with *Ptolomie*, and the ancient Geographers before him, as we shall shew hereafter. This distinction of the Terrestriall Spheare into *Climates* is somewhat a more subtile distinction then the former by zones; forasmuch as that is made by the combination of such Parallels as are principally named and of chiefe note, as the Tropicks and Polar circles. But this indifferently respects all without difference. The first beginning and measure, as well of this as all other measures of the earth is the *Æquator*, for that which is most perfect and absolute in every kinde ought to be the measure of all others. But yet we must vnderstand, that although we beginne our account of the Climats from the *Æquator*; yet the *Æquator* it selfe makes no Climate, but onely the Parallelles which are therewitho correspondent. For as it is before shewed, vnder the *Æquator* it selfe, the artificiall daies are all æquall in length, containing only twelue houres: wherefore beginning from the *Æquator* betwixt that & the third Parallel, we count the first climate: from the third to the sixt, the second Climate: and so all the rest, making the number of the Climats double to the number of the Parallelles; so that one and the selfe same Parallel, which is the end, and bound of one Climate is the beginning of the next; whence we see that to the constitution of euery Climate three Parallelles concurre, whereof two are extreme, comprehending the breadth of the said Climate, and one diuiding it iust in the midst. A Parallel therefore differs from a Climate, as a part from the whole, being one circle correspondent to the *Æquator*, whereas a Climate is a space contained in three Parallelles. Secondly, as a Parallel is conceaued to adde to the artificiall day one quarter or fourth part of an houre; so a Climate makes halfe an houre; so that by how much any Climate is distant from the *Æquator*, by so many halfe houres the longest day of that Climate goes beyond the longest daie of the place vnder the *Æquator*. These Climats therefore cannot bee all of one æquall quantitie; because the *Æquator* is a greater circle, and comprehends

comprehends the greatest space in the Earth: so that it must needs follow that these Climates neare the Aequatour being made by the combination of greater circles are greater then those neerer the Poles. But because all Climates are made by the combination of Parallelles; we are to understand that there are three sort of Parallelles to be knowne in *Cosmographie*: The first are those which doe distinguish the latitude of places, taking their beginning from the Aequatour; and are in an ordinarie Globe or Mappe distinguished, sometimes by 10, sometimes by 15 degrees. The second kinde of Parallelles are those that make the zones, which are indeed some speciall named Parallelles, as the Tropicks and the Polar circles: The third sort are called Artificiall Parallelles; because they shew the distances of artificiall daies and nights, which are commonly noted in the margin of a Geographicall Mappe, which last sort of Parallelles are here chiefly to be vnderstood.

1 *The Zones and Climates agree in forme but differ in greatnessse, number and office.*

The Climates are so called (as we haue said) because they decline from the Aequatour, and are spaces of the Earth containing two Parallelles, in which the longest day is varied by halfe an houre. These agree with the zones in some sorte: for both of them are spread by the latiude of the Earth, and by Parallel circles compasse it about as so many girdles: Neverthelesse they differ one from the other. 1 In *Greatnesse*, because the zones are greater, the Climates lesser spaces in the Earth. 2 In *Number*, because there are only five zones, but many more climates. 3 In *Office*, vse and effect, because the zones are to distinguish the mutation of the quality of the aire and shaddowes according to diuense Regions of the Earth: but the Climates are vsed to shew the greatest differences of houres in the day: to shew the variation of the rising and setting of the starres. for places vnder the same Climate haue the same quantity of daies and nights, the same rising and setting of the stars, whereas places seated vnder diuense climats haue a great variation in the daies and nights, and a diuere rising and setting of

the starres; for as often as the longest or Solstitiall day of one place, differes from the longest day of another by the space of halfe an houre, a new Climate is placed: wherefore vnder the \textcircumflex Equatour or middle part of the earth the daies are alwaies æquall, to wit, of 12 houres: which beginning from the \textcircumflex Equatour, if we approach towards either Pole, so farre as the greatest artificiall day amounts to $12\frac{1}{2}$, wee may assure our selues that we are come to the first Climate: and so forward still the greatest day of our Climate will by so much exceed the greatest day of the other. As the Climates differ one from the other by halfe houres, so the Parallels by quarters, as we haue shewed: and shall more fully explaine in this Chapter.

2. *The Climates compared one with the other, are not all of the same greatness.*

Although the Climates are placed according to æquall increase of daies and nights, yet suffer they a great inequality: For no Climate is æquall to another in the same Hemisphere, but are still greater then other, by how much neerer they are to the Equinoctiall circle; for the latitude of the first Climate is reckned to be about 8 degrees, which make 480 Italian miles: but of the last not so many minutes as quarters of miles.

11. In Terrestriall Climates, two things are to be vnderstood; 1 The *Invention*: 2 The *Distinction*. The Invention teacheth the manner how to finde out in what Climate any place lieth. The finding out of any climate depends vpon the obleruation of the length of the day; for the length of the day being once knowne, the Climate will also be found out by this Rule.

1 Double the houres aboue 12, and the Product will shew the Climate. The

The reason of this rule is intimated before; to wit, that the climates are distinguished the one from the other by the space of halfe an houre of the longest day: Now the daies vnder the æquatour are alwaies æquall, containing 12 houres in length: from which towards the Pole they are increased by degrets: wherefore the number of the Climates must needs be double to the number of houres aboue 12: as for example, if I should finde out in what Climate *England* is situated: I find the length of the longest day to be about 18 hours, which is six hours more then 12; this I double, and it will bee 12; whence I collect, that *England* is situated vnder the 12 Climate: A more compendious way of finding out the Climate of any place, is by a certaine Table, wherein against every Eleuation of the Pole is set the iust Climate: which Table we shall insert hereafter. Here must be noted that this rule which wee haue taught is to be vnderstood of the Climates as they are absolute in nature, and not of *Ptolomyes* Climates: If any man would finde out the Climates of *Ptolomie*, bee must first cast away three quarters of an houre, which is 45 minutes; because his Climates, as we shall shew, beginne not immediatly from the Equatour, but from the latitude of 12 degrees.

12 Thus much for the *Invention*: the Distinction of Climates is into *Northerne* and *Southerne* Climates: both these againe are of two sorts, either proper or improper.

13 The proper Climates are those which are placed between the *Æquatour* and the point neere the Polar circle: The improper are those from the Polar circle to the Pole it selfe.

We must understand that the Climates are considerd two manner of waies, 1 Absolutely in respect of the whole *Terra* *small* *Spheare*. 2 Comparatiuely, in respect of the knowne ha-

bitable part of the Earth: According to the latter considerati-
on the ancient Geographers haue otherwise distinguished the
Climates then the new writers: whence ariseth a great diffe-
rence and confusion amongst them, in defining the number of
the Climates. For sometime they will haue a new Climat put
whensoever the day increaseth a quarter of an houre: some-
times at halfe an houre, sometimes at difference of an whole
houre or day. But the doubt is easily answered, and reconciled
by our former distinction; for whereas they put the difference
of Climates to be halfe an houre, it is to be vnderstood of these
which are proper Climates betwixt the Equatour and the Po-
lar circle; for it is certaine that beyond this circle the artificiall
day increaseth, not only by houres, but by daies, weekes, and
months; so that another account must be made of such Climates
then of the former. But it hath beene generally taken for those
Climates of the Ancients: now the distinction of Climates am-
ongst the Ancients is of two sorts. The first was of the Geo-
graphers before *Proloemie* who placed the vttermost bound
Northward in the 25th degree of Latitude or Eleuation, & so
made only seauen Climates. These 7 Climates were all vnder-
stood to be in the habitable parts wherein they were marked
and designed out vnto vs by names taken from *Cities, Moun-
taines, Regions*, and such like remarkable places, where wee are
to conceaue that climate as neere as may bee guesst to : unne
through the middle of any such Region, whereof it takeith its
name: But the better to vnderstand the Distinction of the Cli-
mates, as well with the Ancient as Moderne Cosmographers,
we will insert this following Theorem.

1. In the placing and Number of the Climates
and Parallelis, there is a great diversitie be-
twixt the Ancient and Moderne Geogra-
phers.

This hath beene before mentioned: but for better distinction
we haue reserved the handling of these differences to this pro-
position

position, which may serue as a Corollary to the rest. First wee take it as granted that *Ptolomie* so appointed the Parallelis (out of which the Climates must arise) that hee numbred 38 both waies from the Equatour: to wit, 38 towards the South, and so many towards the North. These Parallelis he so distinguished, that 24 he numbred by quarters of houres, foure by halfe houres, foure by whole houres, & six by whole moneths. Hence is it that Geographers say, that a new Parallel is to be placed sometimes whereas the longest day increaseth by a quarter of an hour; sometimes where it increaseth by a halfe, sometimes by a whole houre, sometimes by a whole moneth. The first is to be vnderstood of those 24 Parallelis which were deliuered by the Ancients before *Ptolomie*. The second, third, and fourth of such as were vnowne vnto those Ancients before *Ptolomie*. To reduce all iato order we will set down this distinction. The distinction of the Climats is either ancient or new. The Ancient was againe twofold: either former or later. The former was that which was set downe before *Ptolomies* time, wherein there were assigned 7 Climats according to the common opinion (though *Mercator* grants but 5) These Authors placed their Northerne bound in the 25 degree of elevation: The later distinction was almost the same; but somewhat corrected by *Ptolomie*, who placed 9 Climats towards the North. The first passed by *Meroe* a City of *Aethiopia*, where the longest or Solstitiall day is 13 houres. The second by *Siene* in *Egypt*, where the longest day is 13 $\frac{1}{2}$. The third by *Alexandria* in *Egypt*, where the longest day is 14 houres, The 4th by the Iland of *Rhodes*, where the longest day is of 14 $\frac{1}{2}$. The fift by *Rome*, where they haue the length of the longest day 15 houres. The sixt by *Pontus*, where the longest day is 15 $\frac{1}{2}$ houres. The seauenth by the mouth of *Borispheres* where the longest day is of 16 houres. Neverthelesse some haue drawne the 6 Climate by *Borispheres* in *Sarmatia*, and the seaventh by the *Riphean* mountaines. *Ptolomie* to this number addes two more, and so reckons them that the 8 should passe by the *Riphean* mountaines, and the 9 by *Denmarke* where the day at longest is 17 houres. To these Northerne Climats they opposed

opposed so many towards the South, which they called Anti-climates. These as it should seeme in Ptolomies time were Imaginaiy altogether, because few or no places were discouered at that time beyond the Line. But to leaue Ptolomie and his old Authors, and examine the industry of later Geographers, we shall finde the Distinction of the Climats to be two-fold; either vnpfefct wherein they numbered onely 19 Climats; or perfect, wherein they accounted 46 or 48, of which 23 or 24 were Northerne, and the other on the opposite part, to wit, in the South. The perfect distinction of the Climates is againe (as later writers speake) either certaine or vncertaine. The certaine they call that wherein the Climes are distinguisched and ranged from the Equatour to the Polar circle: For sithens the Northerne Regions are now discouered beyoud 70 degrees of the Elevation of the Pole, and a Climate is defined to be a space comprehended betwixt three Parallelis in the habitable Earth: wherein the length of the longest day is increased by halfe an houre; Therefore it must needs be, that from the Equatour to that habitable part of the Earth, wherein the longest day is 24 houres (which is not far from the Pole circle) there should be placed 24 Climats. The vncertaine distinction they call that which is betwixt the Polar cirele, and the Pole it selfe, which may be termed *Improper*; because in these Climats the day is not increased by halfe houres, as in the former, but first by whole *Daies*, then by *Weekes*, and last of all by whole *Moneths*: Insomuch that vnder the Pole it selfe they haue 6 Moneths perpetuall day, and so long againe a continuall night. The Parallelis whereof the Climats are made, were set downe by Ptolomie 38 (as we haue said) but the later writers haue placed them so farre Northerinely, that they reach to that tract wherein the Sun tarries aboue the *Horizon* a whole 24 houres, and so haue numbered 23 or 24 towards the North, and so many towards the South. The cause of this diuersitie is because some drawe the first by the mouth of the *Redde - Sea*: others by *Meroe*: for the farther consideration of these climats corrected by later Geographers, they beginne their account from the Equatour it selfe, which in this case is the best rule of certainty.

certainly; because we hold that whole tract of Earth to be
habitable, as we shall proue in our second booke.

**14 A Parallell is a space wherein the longest
day is increased by a quarter of an houre.**

Concerning the Parallells, little can be said more then we haue
opened in the doctrine of the Climats: for (as we shewed) the
one cannot be well vnderstood without the other: onely to a-
void ambiguity of speech, wee must consider that a Parallell
may be taken either for a *Line* or *Circle*, in which sense we took
it in the fist Chapter; where we diuided them into *Named* or
Namelesse: or else for a space bounded by circles as we here un-
derstand it. The neglect of this distinction hath made some
Geographers speake sometimes improperly. The Parallell is
found out by this rule.

**1 Let the number of the longest day aboue 12
be multiplied by 4, and the Product will shew
the Parallell.**

The reason is giuen before in the doctrine of the *Climates*, be-
cause the Parallell space, according to Latitude, is but halfe the
Climate: so that as infinding out the Climate for any place we
ought to double the houres of the longest day aboue 12: so
here we ought to quadruple them, which is to multiply them
by 4: As for example at *Rome* we finde the longest day to be
about 15, which exceeds 12 by 3; which being againe multi-
plied by 4, will produce 12, which is the Parallel for the place.

**2 The Parallells no where divide the Climats
into two æquall parts.**

In the Climats we are to consider two things, either their la-
titude or breadth from North to South: or their longitude or
extent from East to West. In respect of the former wee may
hardly without sensible error call the Parallell halfe the *Climate*, in regard the three lines whereof the Climate consists, to
wit, the middle and the two extremes, are not alwaies of like
distance: but if we consider the extent of the Circumference as

it stretcheth it selfe betwixt East and West, we must needs acknowledge much more: to wit, that of two *Parallels*, diuiding the same climate betwixt them, that that is manifestly the greatest which is next the *Equator*, and that is the least which is neerest to the *Pole*: because the Circles which comprehend their *Parallel* spaces, continually decrease towards the *Pole*: so that if we imagine two men to travel round about the earth the one in a Parallell neerer the *Æquatour*, the other neerer the *Pole*, in the same space of time; it must needs follow that hee should goe farre faster which is neerer the *Æquatour* then the other neere the *Pole*: for howsoeuer *Columella* seemes to make a Parallell to haue in breadth 60 foot, and to intimate by consequence an æqualitie of the Parallells amongst themselues, yet must this be vnderstood of Parallells which are neere one to the other neere the *Æquatour*, which comprehend a great space of land, and admit no sensible difference. Other matters which concerne the *Climates* and *Parallells*, shall be (God willing) vnsfolded in our Tables in the next Chapter, when wee haue spoken of the *Inhabitants*, and such other adiuncts appertaining: without the which this treatise will be vnsperfect, depending for a great part on such circumstances as our method admits not in this place, but immediatly follow.

*CHAP. X.**Of the distinction of the Inhabitants of the
Terrestriall Spheare.*

HAUING hitherto treated of the distinction of spaces bounded by circles in the Terrestriall Globe, to wit, *Zones*, *Cli-*
mates,

mates, and Parallels; we are now to create of the Inhabitants, as such adjuncts as properly belong to such spaces; so farre as it concernes the constitution of the whole Spheare.

- 2 The distinction of the Inhabitants is twofold, either *Absolute* or *Comparatiue*: Absolute as they may bee considered in themselves without any comparison of one with the other.
- 3 The former is againe twofold: either from the *Position* of the Spheare, or the differences of their *Sun-Shadowes*: According to the position of the Spheare the Inhabitants may be said to haue either a *Right*, *Oblique*, or *Parallel* Spheare according to their Horizons.

What these three Spheares are, may appeare by that which we haue formerly spoken concerning the distinction of Horizons in the sixt Chapter of this Treatise, and therefore needs no farther repetition: we are in this place to treat of the severall accidents, and conditions of the Inhabitants. Out of the distinction of the threefold Spheare will arise 13 manners of habitation: which for more order sake, wee will reduce into certaine heads in this manner.

- 4 The people of a right Spheare are such as injoy a right Horizon, whose proprieties shall be declared in this Theoreme.

1. *The Inhabitants of a Right Spheare in respect of the heauens haue the same accidents.*

These accidents are chiefly soure, 1 They enioy a perpetuall Equinoctiall, hauing their daies and nights alwaies æquall the one to the other: because the sunne neuer swaruing from his Ecliptike, hath his course æqually diuided by the Horizon. 2 With the all the stars equally set & rise; because all the Parallells wherein the starres make their Diurnall Revolution are æqually cut by the Horizon. 3 To them the Sunne is twice in the yeare verticall, that is directly ouer their heads, and twice againe in the yeare Solstitiall: The former in the first degrees of *Aries* and *Libra*, the latter in the first degrees of *Cancer* and *Capricorne*: which diuerse positions of the Sunne, some later Geographers haue termed foure Solstices: two higher and two lower. 4 Hence comes it to passe that they yearly enioy two winters, and two Summers: likewise two Springs & two Autumnes. Their Summer when the Sunne is to them verticall: their winter when it is seated in either of the Tropickes. Their Springs & Autumnes while the Sun is passing through the middle spaces betwixt both.

5. *The people inhabiting an Oblique Spheare are such whose Horizon is oblique. The proprieties belonging vnto them are either Generall or Speciall.*

6. *The Generall are such as agree to all those which inhabit an oblique Spheare.*

1. *All the Inhabitants of an oblique Spheare agree in two proprieties.*

These two proprieties wherein they agree are these. 1 To all the Inhabitants without the Æquatour vnder what Parallell soever, the daies are æquall to the nights only twice in a yeare, to wit, either in the beginning of the Spring, or the beginning

of the Autumn. At other times either the daies increase above the nights as in the Summer, or grow lesser as in the winter. 2 To these inhabitants some starres are perpetually seene, as such which are neare the Pole to which they incline: some are never seene, as such as are farthest off from the said Pole; some rise and set, which are those which are in the middle space betwixt both; which are sometimes visible, and sometime hid.

7 The speciall Accidents of an Oblique Horizon, are such as agree to speciall places in the same Spheare.

I. *The Inhabitants of an Oblique Spheare are of five sorts, injoying so many correspondent properties.*

The first sort are of those, whose Zenith is betwixt the *Æquator* and one of the *Tropickes*, even ynto the 23. Degrees, 30. Scruples of elevation of the Pole: In such a sort, towards the North betwixt the Line and the *Tropicke of Cancer*, are placed the inhabitants of *Zeilan*, the extreme part of the *East Indies*, *Hispaniola*, *Guinea*, *Nubia*, with some part of *Arabia fœlix*, and all other places betwixt the *Æquator* and the *Tropicke of Cancer* in the *Torrige Zone*. Towards the South in the same Latitude, are placed the *Brasilians*, the *Peruvians*, the *Canans*, with many others. The Accidents which happen vnto these Nations are these, 1. They may see all the starres except a few which are neare the Pole. 2. Their dayes and nights are somewhat vnæquall, so that their longest day, or longest night, is not alway of the same quantity. 3. Twice in the yeare they haue the Sunne verticall, but without the *Æquator*. 4. They haue two Summers, and two Winters, but not æqually tempered. 5. The length of their longest day reacheth to 13. 2 houres.

The second sort are such as inhabite vnder the *Tropicke it selfe*, whose elevation of the Pole is æquall to the greatest de-

clination of the Sunne, which is 23. degrees, 30. Scruples. Vnder the Tropicke of *Cancer* is placed a great part of *Arabia felix*, *East India*, the Southerne parts of *China*, the higher parts of *Egypt*, and *Siene*. Vnder the Tropicke of *Capricorne* are placed the people of *Monomotapa*, and *Madagascar*, with other places: The accidents belonging vnto them are these, 1. To them appeare all the starres comprehended in one of the Circles, but none of the other. As for example, to those inhabiting the Tropicke of *Cancer*, the starres included within the Articke Circle alwayes appeare, but neuer those which are in the Antartickie: likewise to those which dwell vnder the Tropicke of *Capricorne*, all the starres appeare which are contained within the Antartickie Circle, but none of those included within the Articke Circle. 2. By how much nearer the Sun approacheth to their Zenith or Verticall point, by so much are their dayes lengthened; and by how much farther it goes off, by so much are they shortned: so that they inioy then their longest day, when the Sunne directly passeth by their Zenith. 3. To them the Sunne is verticall but once in the yeere: to wit, to those vnder the Tropicke of *Cancer*, when the Sunne enters into the signe; as to the other when it toucheth the first Degree of *Capricorne*. 4. They haue but one Summer and one Winter throughout the yeare.

1. The third sort, are such inhabitants as dwell in one of the temperate Zones betwixt the Tropicke and the Polar Circles from 24. Degrees of elevation, to 66. Degrees, 30. Scruples. Such inhabitants towards the North, are (as we haue shewed) almost all the inhabitants of *Europe*, *Asia maior*, and part of *Africa*: as on the other side towards the South, the *Chylienses*, the farthermost *Africans*; and those that dwell neere the straits of *Magollane*. Their properties are chiefly these, 1. Many starres are by them alwayes seene, and many neuer appear. 2. Their dayes notably differ in inæqualtie. 3. The Sunne neuer arrives at their Zenith, but is alwayes on the South of those which inhabite betwixt the Tropicke of *Cancer*, and the Articke Circle, and alwayes on the North side of such as dwell in the opposite temperate Zone. 4. They haue in the

yeare

yeare but one Summer and Winter, but by reason of the diversitie of places much vnæquall: for where the elevation of the Pole is greater, the winter is much harder; but where it is lesser it is more temperate.

The fourth kinde of inhabitants, are those which reside vnder the Polar Circle, (which is their Zenith) where the temperate Zone endes, and the cold beginnes: where the elevation of the Pole is beyond 66. Degrees 30. Minutes, in which Tract lies *Nova Zembla*, with many other Islands not yet well discouered in the North: and perhaps as many more vnder the Antartick Circle towards the South, lesse knowne than the other. The accidents belonging to them are these, 1. Those which inhabite vnder the Arcticke Circle, see all the starres included within the Tropicke of *Cancer*, but neuer those within the Tropicke of *Capricorne*: Likewise, those which liue vnder the Antartick Circle, see all the starres within the Tropicke of *Capricorne*, but neuer those within the other Tropicke of *Cancer*. 2. Their longest day at Midsummer is 24. houres, their night then being but a moment: likewise their longest night, as at Mid-winter, is but 24. houres, their day passing not a moment. 3. The Center of the Sunne every yeare twice toucheth at their Horizon. 4. The Sunne at Noonetide is alwayes on the South of those which dwell vnder the Arcticke Circle, except it be in the Summer Tropicke, when it is the Mid-night, or Northerne point: likewise to those that are vnder the Antartick Circle, the Sunne at noone is alwaies on the North side, except vnder the Winter Tropicke. 5. They haue in the yeare one Winter and one Summer: but the Winter farre colder, and the Summer slacker then in the fornamed places.

The fift and last habitation, is of those which are included betwixt the Polar Circle, and the Pole it selfe, from 66. Degrees and 30. minutes of elevation to 90. In which Tract little is discouered Northward; and in the South climate nothing at all. The speciall Accidents appertaining to them are these, 1. With them a few starres are seene to set and rise. 2. They haue an *Æquinoxe* the Sunne touching the first Degree

gree of *Aries* and *Libra*. 3. They of the North Zone haue more dayes about the middle of Summer, and more nights in the Winter: likewise, they of the South frozen Zone, the contrary. 4. They haue extreme cold Winters, and in stead of Summer, a small remission of cold. 5. The signes of the Zodiacke to them preposterously rise.

8 The inhabitants of a *Parallel Spheare* are discouered in this proposition.

1 *The inhabitants of a Parallell Spheare enjoy but one kinde of habitation, in respect of the Heauens.*

A *Parallell Spheare* I here accurately vnderstand for that position of the Globe, wherein the Pole of the world is precisely placed in the Zenith, or elevated to 90. degrees of Altitude: because onely in such a site, the *Æquator* and the *Horizon* agree in one, and lie parallel to all the rest of the *Parallell Circles*: which places, whether it be at all capable of habitation by reason of cold, we shall discouer hereafter in the second part: but out of supposition admitting a place of habitation, these accidents will happen, 1. The fixt Starres which they see, are alwayes seene so, that with them there is no point of East or West; for the Starres neuer rise nor set. But the Planets rise and set, but not by their diurnall, but proper motion. 2. They haue a continuall day of sixe moneths, and a night also as long, the Sunne rising continually in the first degree of *Aries*, and setting in the first of *Libra*. 3. The sun in the *Æquinoctiall points*, for all the time that he is about the *Horizon* (as all the other Starres) is turned round about in manner of a wheel. 4. The *Æquator* serues in place of the *Horizon*, and the *Æquator* is every while æquidistant from the *Pole*. 5. They haue one Winter and one Summer, the former exceeding cold, the latter lesse warme then ours.

9 The second distinction of the inhabitants

of the earth is taken from their *Noone shadowes.*

The Sunne in diuers parts of the earth diuerely spreadeth his shadowe, because the *Gnomons* or *Opacous* bodies by which the shadowes are made in the earth, are in diuers places diuerely opposed, or obiectet to the Sunne: for whereas the Sunne so runnes in his *Eclipticke* Circle betwixt the two Poles, that though his passage be in an oblique Circle, yet he never comes so farre as the Poles themselves: it necessarily must be, that sometimes he should shooe forth his beames *perpendicularly*, as when it is in the verticall point of a place; sometimes *Obliquely*, as when he declines either one way or other from the verticall point; sometimes in *parallel* wise, forasmuch as in some places of the earth, the Sunne cleauing as it were to the Horizon, casts out his beames *parallel* and *equidistant* to the plaine of the Horizon. The right or *perpendicular* beames of the Sunne, falling on the superficies of the earth at right Angles, are turned and reflected into themselves, and so make no shadowes at all. But the oblique beames, in that they are not reflected into themselves, must of necessity produce shadowes, yet in diuers manners; for those Sun-beames whch obliquely project themselves on the plaine of the earth, so as they come not from the Horizon it selfe, will make such kinde of shadowes as shall proportionally agree with their *Gnomons*, or *Opacous* bodies, and such whose magnitude may in a manner be designed out, and certainly measured by the sight. But on the contrary part, the beames which are esteemed *parallel* to the plaine of the Horizon, finding no solide obstaclē or let, shooe forth infinitely, making no Angels on the superficies of the earth, and can haue no proportion at all with their *Gnomons*, that the shadow may be any way designed by our eyes. But here we are to consider, that the shadowes chiefly to be considered, are the *Meridian* or *Noono-shadowes*, which take their distinction from the diuers incidencie of the beames, which the Sun casts forth at noone. According to this manner,

10 The inhabitants of a place in respect of the shaddowes, are either *Amphiscij*, *Heteroscij*, or *Periscij*. The *Amphiscy* are those, whose Noone-shaddowes (but at diuers times of the yeaire) are cast both wayes ; that is to say, North and South,

Amphiscij signifies as much as people of a double shaddowe : such are they which inhabite betwixt the *Æquator* and the *Tropicke*, where the elevation of the Pole equals not 24. degrees : These men haue the Sunne twice every yeaire in their Zenith or verticall point, and then they make no shaddowes at all ; and therefore they are called *Aſcij*, or without shaddowes. But when the Sunne passeth from their verticall point towards the Northerne signes, then at noone it will cast the shaddow towards the Southerne coast : But contrary wise, comming from the Zenith toward the Southerne signes, the shaddow will be darted toward the North, which is evident out of the *Opticke* principles ; because the shaddow is alwaies found to be opposite in place to the *Sun-beames*, the *Gnomon*, or darke body interposed.

11 The *Heteroscij* are those, whose Noone-shaddowes turne onely one way : that is, either toward the North, or tovward the South.

These Nations inhabite in a temperate Zone, betwixt the *Tropicke* and the *Polar Circles*, whereas such as dwell in the temperate toward the North, betwixt the *Tropicke of Cancer*, and the *Polar Circle Articke*, haue their noone-shaddowes cast Northward. But those on the other side of the *Æquator*, dwelling betwixt the *Tropicke of Capricorne*, and the *Antarctike Circle*, cast their shaddowes Southward : Of the for-

mer

mer sort are *Grecians, Italians, French, Spaniards, Germans, Polonians, Suedians, Danes, English*, and the rest inhabiting our temperate Zone: which gaue occasion of that speech of *Lucan the Poet*, concerning the *Arabians* comming into *Thesaly*, in the warre of *Hanniball* and *Pompey*;

*Ignotum vobis Arabes venisti in orbem,
Umbrae mirari nemorum non ire finibras.*

Y^eare come *Arabians* to an vnknowne land,

Wondering the shades here take the Southward hand.

Which verses are in this sense to be vnderstood; Poets are said to looke and turne their faces towards the West, so that the South must of necessitie be counted the left side: Now the place whereunto the *Arabians* came, being a part of *Thessaly*, where such dwell who onely cast their shaddowes one way, to wit, Northward; but *Arabia* their naturall Countrey, being supposed to be included in the *Torrid Zone*, where the shaddowes were said to be cast both wayes, they are said to wonder: The reason why our shaddowes at noone are cast alwayes toward the North, and the others toward the South, is related before, to be because the shaddow doth alwayes occupie or possesse the place opposite to the Sunne, or light body.

12 The *Periscy* are such inhabitants whose shaddowes are mooued round about them in a circular forme.

In some places of the earth the *Noone-shaddowes* take not their beginning from our heads, but of one side, and are extended forward to the plaine of the terrestriall Horizon, and so mooued round about the Opacious body, as about a *Gnomon*: whence they are called *Periscy*; whiche is as much to say, as men hauing shaddowes mooued round about; such is their habitation which are included in the *Frigide Zone*, circumscribed within the Polar circles, and the Poles: Here the Sunne never directly passeth by the crowne of their heads, but at one side: so that they haue the Pole for their verticall point, but

Ce a Cestudo (tulio) in the

the *Æquatour*, as it were, for their Horizon. These *Periscij* are of two sorts, for some are contained in the *Articke* circle, the other in the *Antarcticke*, whereof both are as yet vndiscouered; especially the *Antarcticke*, being farthest off from our climate.

I. *The habitation of the Amphiscij comprehends 7. Parallelis, of the Heteroscij 41. of the Periscij 6. Moneths.*

Of the nature and accidents of these three sorts of people there needs no more to be spoken, then we haue deliuered before in this Chapter: Neuerthelesse, for a recapitulation of our former doctrine in this and the precedent Chapter, it will not be amisse to insert this Table of Climates, set out by our exactest *Geographers*; wherein is expressed (as it were) to our view the respect and seuerall accidents, which belong to these severall inhabitants.

13. Thus much for the Inhabitants absolutely considered: The inhabitants compared one with the other according to their position, are the *Periæci*, *Antæci*, and *Antipodes*.

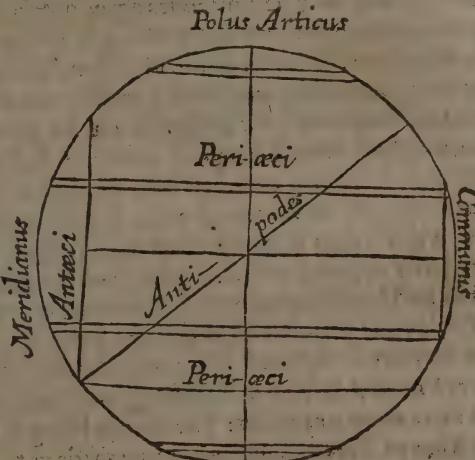
14. The *Periæci* are those inhabitants which dwell in the two opposite points of the Parallel circle.

15. The *Antæci* are such as dwell vnder the same *Meridian*, but in diuers *Parallelis* æqually distant from the *Æquatour*.

16. The *Antipodes* are such as inhabite vnder one *Meridian*, but vnder two *Parallelis* æqually distant from the *Æquatour*, and two opposite points of those *Parallelis*. These

These names being originally Greeke are taken from the diverse manner of dwelling of one nation in respect of another. The *Periæci* are called such as dwell(as it were) about the Hemisphere in the same Parallel in two opposite points: the one in regard of the other being *Easterne*, the other *Westerne*: so that they are supposed to differ the one frō the other 180 degrees which is the semicircle:

where we are to note, that these degrees are to be numbered, not in a greater but a lesser Parallel, which is leſſe then the *Æquator*. For they which are vnder the *Æquator* it ſelue in 2 opposite points



Polus Antarticus

are to be accounted rather Antipodes, although (for ought I ſee) the name might agree. The *Antæci*(as the name imports) are ſuch as dwell one againſt another, hauing one ſelfe ſame Meridian and æquall diſtance from the *Æquator*, the one in the Northerne, the other in the Southerne Hemisphere. The *Antipodes* (otherwife called *Antichthones*) may popularly be deſcribed to be ſuch as dwel feet to feet ouer againſt the other, ſo that a right line being drawne from one ſide to the other, wil paſſe by the Center of the world: whence they preſcely are diſtant the one from the other 1800 in a greater circle: wherein they are diſtinguished from the *Periæci*, which are diuided by the degrees of a leſſer circle: ſuch compared one to the other are the *Americans* and the *Easterne Indians* about the riuer *Ganges*; the Inhabitants of *Peru* and *Caleſute*; those of *Peria* &c.

Summatra to England I finde no other Antipodes but the Sea, or at least some parcell of land in the South continent neere *Pistacorum Regio*: Here is to be noted that the former definitiō of *Antipodes* giuen by the ancients, was only to be vnderstood of the knowne habitable part of the Earth; because such as dwell directly vnder the *Æquatour*, or either of the *Pol's*, although they may be Antipodes agree not to that definition: by reason the former are Antipodes only in opposite points of the *Æquatour*: the other of the Meridian. Whether there were any Antipodes or no, was made a question amongst the Ancients, insomuch that Saint *Augustine* in his booke *de civitate Dei*, and *Lactantius* in his third booke of *Institutions*, seemes stifferly to defend the contrary: which opinion is supposed to growe out of their contempt or neglect of *Mathematicall* studies, in those ages wherein the zeale to religion was most vnecessarily opposed to Philosophie, and the mistresse forsaken of her best hand-maides: which ignorance of the Ancients was so far derived to posterity, that in the yeare of our Savior 745 one *Boniface* Bishop of *Mens*, was accused before Pope *Zachary Virgilinus* Bishop of *Salzburg*, for heresie, in that he averred there were Antipodes: The matter being first preferred to the King of *Bohemia*, and an appeale made vnto the Pope, it happened that the honest Bishop for this assertion, was flatly condemned for hæreticall doctrine, and inforced to recant his opinion: yet is it wonderfull how such matters were thus decided: for granting these two easie grounds, First that the earth is *Sphericall*, a proposition proued in their time; 2 That every place, or at least two opposite places in the Terrestrial Spheare may be habitable; it must of necessity follow, that such Antipodes must be granted: which makes me to imagine that Saint *Augustine* absolutely and grossly denied not the *Antipodes*; because in setting downe the premisses and grounds of our opinion, he seemed to understand them too well to deny a necessary induction, being a man of so great a wit, and apprehension: but questionlesse he thought that the Torrid Zone, which by most of the Ancients in his time, was reputed vnhabitable and vnpassable, no man had yet set his foot in those remote

parts

parts beyond the line: so that it seemed in him not to arise out of ignorance of the constitution of the earthly Globe: but out of the receaued opinion of the Torrid Zone, and the vast Ocean: the one of which he held vnhabitable, the other vnpassable: from whence also sprang vp an argument, or rather an idle fance, that the Antipodes could not be admitted without granting another Saviour, and another kinde of men besides Adams: posterity: for if this coniecture had not taken place, the Pope (I suppose) would neuer haue proued himselfe so ridiculous a Judge, as to haue condemned *Virgilius* for hæresie. As for *Laetantius* (howsoever otherwise a pious eloquent Father) the weaknessse and childishnesse of his arguments, will to any indifferent reader discouer his ignorance in the very first rudiments of Cosmographie. Here we may learne how farre religion it selfe is wronged by such who set her opposite to all her seruants. But whatsoever the Ancients out of their glimring reason haue coniectured, our times haue sufficiently decided this controuersie; wherein such Antipodes are established both by reason and experience: which matter we shall referue to our second booke; wherein we shall declare how farre, and in what sense the Earth may be tearemed habitable.

1. *Those which are to vs Periceci, are the Antœci to our Antipodes: our Antœci, the Periceci to our Antipodes: likewise our Periceci are the Antipodes to our Antœci.*

This Proposition as a Corollary may by necessary consequence be deduced out of the precedent definition, and be well expressed out of the constitution of the artificiall Globe, and needs no farther demonstration.

2. *The Periceci, Antœci, and Antipodes are diuersly distinguished in respect of the celestiall appearances.*

The proprieties of the *Periceci* are chiefly foure. 1 They haue the same elevation of the Pole, and therefore the same temper-

of the yeare, and the same length of daies and nights. 2 They dwell East and West in regard one of the other. 3 They haue contrary times of daies and nights: for when the one hath his Noone, the other inioyes his mid-night; likewise when the sun with the one riseth, it setteth with the other. 4 They haue the same Zone, Climate, and Parallel; but differ by a semicircle, to wit, 180 degrees. To the *Antæci* they haue likewise assigned 5 proprieties. viz. 1 They inhabite the like Zones, but in diverse Hemispheres. 2 They haue the same elevation of the Pole, but not of the same Pole: because the one sees the Pole *Arctick*, the other the Pole *Antarctick* æqually raised aboue his *Horizon*. 3 They haue Noone and Mid-night iust at the same times. 4 They inioy the same temper of the Heauens. 5 They haue the seasons of the yeare contrary. For when the Southerne *Antæci* haue their Summer, the Northerne haue their winter; and contrariwise: when the Northerne, haue their Spring, these haue their Autumne. To the *Antipodes* they haue allotted 3 Proprieties. 1 That they haue the same elevation of the Pole, though not of the same Pole. 2 They haue the same temper of the yeare, and the same quantity of daies and nights. 3 They haue all the other accidents contrary: For when the one hath Night the other hath Day, when one Winter, the other Summer; when the one the Spring, the other Autumne; and contrariwise. These accidents and proprieties here mentioned, must be vnderstood in respect of the Heauens only. The qualities arising from diuerse other Accidental and particular causes in diuerse places of the Earth, we shall differre vnto our second part.

C H A P. XI.

Of the Longitudes and Latitudes.

1. The distinction of the Terrestriall Globe according to certaine Spaces, being formerly explained, wee are now to treat of the Distinction of the said Spheare according to certaine Distances.
2. A Distance here we understand to be a direct line drawne betwixt two points in the Earth: such a Distance is tvvofold, either Simple or Comparative.
3. The Simple Distance is taken from the tvvo great circles: to vvit, the Meridian, or the Æquator: vvhich is either the Longitude or Latitude.

The division of Distances into the Simple or Comparative, is most necessary: for it is one thing for a place absolutely taken in it selfe, to bee distant from some fixt point or other in the Globe: Another for two places to be compared betwixt them sevnes in regard of such a fixt point: forasmuch as the former implies only the distance betwixt two points the other the distance of two such points or places in respect of the third. These points, from which such points are said to be distant, are either found in the Meridian Circle, from which the Distance is called Longitude; or else in the Æquator, whence wee call it Latitude.

4 The Longitude is the distance of any place
Eastward from the first Meridian.

To understand the better the Longitude, we must consider that it may be taken two waies: either *Generally*, or *Specially*: In the former senie it is taken for the Distance of the whole Earth, stretched from the West vnto the East, and contrariwise from East to West. The bounds or limits of this Longitude were by *Ptolomie* and the ancient Cosmographers set no farther distant then the halfe circle, containing 180 degrees; because the rest of the Earth lay at that time vndiscouered. The end of this space towards the East, was the kingdome of *China*, at the furthest part of all *India*, distant, as wee said, from the *Fortunate Islands* where *Ptolomie* placed the first Meridian, 180 degrees: which being taken in the Meridian, and resolved into Miles, according to our former rules, will give 10800 *Italian miles*: but this space delineated our by the Ancients, was very scant and narrow in respect of the other parts since found out, being added to the former. For beyond the bound set by *Ptolomie* in the East, it is manifest that 60 degrees are found out, and made knowne. An example whereof we haue in *Scythia* without the mountaine *Emaus*, which is knowne to extend it selfe 60 degrees Eastward towards the kingdome of *Cathay*, discovered by the *Portugalls*: so that the breadth of the Earth Eastward is fully knowne so far as 240 degrees, which being measured in the *Æquator* will amount vnto 1400 miles. Moreover towards the West, beyond the *Fortunate Islands*, it is knowne to stretch to the furthest border of *America*; so that 340 degrees of the earth is fully detected, if not all the rest being only 20 degrees, which are only deficient to make vp the whole circle. Which we may the sooner credit; because our times haue brought forth (for ought any Authors haue related) the most excellent Nauigators of all ages; which haue sailed the vast Globe of the Earth round about, and let behinde them a foundation whereon others might easily build. But to let passe the Generall Longitude of the Earth betwix the East and the West; Wee must understand that the Longitude here mentioned

mentioned is to be taken in a more speciall sense, for the Distance of any place from the first Meridian, being placed either in the *Canaries*, as the Ancients would haue it, or in one of the *Azores* according to the latter Geographers. This then must be the bound from whence we must beginne our account; The subiect wherein the number of degrees may be taken, may bee the *Æquator* or Parallel. Whence by some the Longitude of a place is defined to be an Arch of the *Æquator* or Parallel intercepted betwixt the first Meridian and the verticall point of the place proposed: so that by necessary consequence, such places as are subiect to the same Meridian, in the same Hemisphere, Easterne or Westerne, haue the same Longitude, which is the distatice from the point of the West: but places declining more towards the East haue the greater Longitude; but nearer to the West, lesse.

1. *Places injoying the same Longitude, are not alwaies equally distant from the first Meridian: and contrarywise places equidistant from the first Meridian haue not alwaies the same Longitude.*

The reason is evident out of that which hath beeene often spoken before: because the degrees of a greater circle are greater, of a lesser lesse, according to the greatnessse of the circle. Now the Longitude of a place measured in the *Æquator*, will answere to 60 Italian miles: but in other Parallels lesse.

2. *The difference of Longitudes begets the difference of Times: Those therefore which exactly are subiect to the same Longitude, haue their Noone at the same moment: but where the Longitudes are different, the Noonetides are also different.*

That the difference of time is varied according to the difference of Longitude in diuerse parts of the Earth, is a matter obvios to every mans ynderstanding, out of two premised grounds. 1 That the Earth is Sphærical. 2 That the Sunne in his Diurnall course once in 24 hours compasseth it round: whence it comes to passe that places situate *Eastward*, see the Sunne sooner then those which are placed in the West, & that with a proportionall difference of time, that to every houre in the Sunnes motion is assigned a certaine number of correspondent miles: which is in some sort expressed in a Geographicall Globe or Map, wherein we shall finde described 12 Meridians, which diuide the whole compasse of the earthly Spheare into 24 equal parts; in such sort that betwixt each of the two neerest Meridians, are reckned 15 degrees, which make one houre: by which we may moie easily ynderstand how soone the Noone time happens in ne Citty before another: for if one Citty stands Eastward from another the space of three of those sore said Meridians, it is evident that it will injoy noone three houres before the other. The reason of this difference of times, is the difference of Longitudes, wherein to every houre the Cosmographers haue allotted 15 degrees in the Sunnes Diurnall motion: so that 15 degrees multiplied by 24 hours, which is the whole naturall day, there will be produced 360 which is the number of degrees in the whole circle.

3. If two men from the same place travell, the one Eastward, the other Westward round about the Earth, and meet in the same place againe: they shall finde that hee which hath gone Eastward hath gotten, and the other going Westward hath lost a day in their account

This is without difficulty to be vnderstood, out of the change of Longitudes, seconded by their travell, varying perpetually the quantity of the day: for it is manifest, that he who from any place assigned saileth Eastward, mouing continually against the

the motion of the Sunne, will shorten somewhat of his day; taking away so much from it, as his iourney in proportion of distance, hath opposed and anticipated in the time the Diurnall course of the Sun: so that dailie gaining som:thing from the length of the day, which must be elsewhere recompensed. It must needes be, that in the whole circuite of the earth, it will amount to 24. hours, correspondent to the whole circuite of the Sunne, and the compasse of the earth, which will make another day: Likewise, if we suppose another in compassing about the earth, to goe Westward, it cannot be otherwise imagined, but that seconding the course of the Sun, by his owne iourney; he will daily adde somewhat to the length of his day, answerable to his distance, from the place wherein he began to follow the Sunne in his course from East to West. The daily addition to the length of the day, proportionall to the longitudes which he changeth, (the Sunne running a like courle) must daily diminish somewhat of the Diurnall course of the Sunne, and so at his iourneys end, which was supposed to be the whole circuite of the earth, answerable to 24. hours in the Sunnes course, it will loose a whole day. To demonstrate both these cases, we will imagine in supposition, that of these two trauailers going the one Eastward, the other Westward, the former shoulde take away from the length of the day, or the latter adde to it, for euery 15. miles one minute. Then by the golden Rule, if 15. miles eithier subtract or adde one minute in the length of the day, must 21600. miles, which is the whole compasse of the earth, according to the same proportion, either subtract or adde 1440 minutes, which make 24. hours, the length of the naturall day. To confirme the demonstration by popular experiance, I remember I haue read in the *Hollanders* discouery of *Fretum de Mayre*, that comming home into their owne Countrey, they found by comparing their accounts with their countreymens at home, they had lost one day, hauing gone Westward, & so compassed the earth round. Hence will arise diuers consequences not unpleasing to be scann'd. One I will touch not much dissonant from our purpose; *That three men residing*

in the same place at one time, shall notwithstanding all vary one from the other in the dayes of the weeke, keeping yet an exact account: which to explaine the better, we will suppose a *Jew*, a *Sarazen*, and a *Christian*, residing in the same towne together: It may so happen according to our former grounds, that the *Sarazen* according to the Law of *Mahomet*, shall obserue his Friday, the *Jew* his Saturday, being his Sabbath; and the *Christian* the Lords day, being the Sunday: yet so, as all shall happen on the same day; all of them excluding any error in their calculation. For supposition sake, we will place them all at one time all together in *Palestine* on a Saturday; at which time, let vs imagine the *Sarazen* to take his iourney Westward, the *Christian* Eastward, so as both of them in their coasts compasse the world, to meet againe in the same place: The *Jew* all the while we suppose resident in the same place; it will follow by necessary consequence, that the *Sarazen* going about the earth Eastward, will loose one day; the *Christian* iourneying Westward, will gaine one day: the *Jew* remaining in the same place, will neither gaine nor loose. These three men then, meeting together againe after a yere, two, or three, at the same place, must needes make a diuers account; for one and the selfe-same day, will be to the *Sarazen* Friday, to the *Jew* Saturday, and to the *Christian* Sunday, if they exactly calculate the time from their first meeting, to their returne vnto the same place. Methinkes this, if there wanted other Arguments, were a reason sufficient to conuince some strait-laced men, who rigidly contend our Lords day (which they erroneously tearme the Sabbath) to be merely morall, as grounded on the Law of nature. If it were so, according to our premises before demonstrated, this absurditie would ensue necessarily: That the Morall Law, which they call also in a sort the Law of nature, is subiect to manifold mutation, which by our best Diuines is vtterly denied. The consequence will easily follow, because it cannot be denied by any *Christian*, but that all nations of the world issued from *Noahs Arke*, the Seminary of mankind, and spread themselues from thence ouer the face of the whole earth, some farther, some at a shor-

ter distance: whereby changing the longitude with their habitation, they must of necessity alter the differences of times, whereon they seeke to ground their Sabbath. Neither at this day can any man exactly and precisely obserue any one day, either as it was first appointed by *Moses* in the *Leuiticall Law*, or as it was instituted by Christ's Apostles afterwards; by reason of the manifold transportation of colonies, and transmigration of Nations from one Region into another, whereby the times must necessarily be supposed to vary. And if any more moderate should vrge, that not the exact seventh day from the first institution, bound vs to obseruation; so one day in seven be obserued: it can hardly passe without exception, forasmuch as if any man, as *Magellan*, *Drake*, or *Candish*, should traualie the world about a day must needs be varied, as we haue shewed. Here I would willingly demand, whether such traualiers returning home into their owne countries, should celebrate the same Lords day according to the institution of their owne Church; or else as they finde according to their owne account: If they obserue the latter, they must schismatically diuide themselves from the Church, and keepe a Sabbath of their owne, which in euery mans judgement would be thought absurd, as the mother of many inconueniences: If the former take place, then must the day be changeable in his nature, and so one day of seven of them should not be obserued. I speake not this to cherish any neglect of the duty we owe that day, but rather to proue it not merely to be grounded on the Law of Nature, as some would perswade; but rather an Ecclesiasticall constitution, deriuied (as it seemes most probable) from the Apostles, though not in practice in Christ's time, wherein the *Jewishe* Sabbath was not yet abolished: But I haue dwelt too long on this, and may perhaps incurre sharpe censure, for wading too farre into the depth of Divinity: But my Apology shall be this, that albeit I haue gone beyond my present subiect, I haue not yet transcended the limits of my profession: I serue no faction, and therefore dare aduenture my language as free as my opinion.

5 Concerning the longitude, two things are to be knowne, 1. The Inuention. 2. The Expression. The Inuention proposeth vs the way and maner of the first finding out of the longitude of places.

There are few things in nature which haue more perplexed the wits of ingenious *Mathematicians*, then the exactest way of finding out the longitude of places: Not that the matter was ouer difficult in it selfe, but that they sought out a way to per-forme this conclusion, not depending from the obseruation of the celestiall bodies and motions; a matter as yet never found out, and I feare me vnpossible: Because they proposed to themselves one of these two wayes to finde it our; either by some magneticall instrument, or else by industry of nauigation: neither of which can much profit. Not the former, because there haue never beene any fixed points found in the *Aquator*, betwixt East and West, as betwixt North and South haue beene obserued: so that nothing can proceed out of the mere nature of the earthly *Globe*, whereon we may ground any difference of longitude: Neither is the second very beneficall, for that all voyages both by Sea & land, are very irregular and vncertaine; either by reason of sundry impediments, as rockes, mountaines, woods, contrary winds, and other dangers turning aside the direct course of passengers from any direct way, or obseruation; or else by the Ignorance of Mariners, which seldome passe so farre-on-discovery: and if they doe, know not perfectly to delineate out their journey, as a *Cosmographer* would expect, to any tollerable satisfaction. Neuerthelesse, by Astronomicall obseruation, we haue many wayes left vs for the performance of this conclusion, as shall be taught in these following propositions.

1 *By an Eclipse of the Moone, the longitude may be found.*

This

This conclusion is in this sort to be performed: First, it behoueth you to know, as you may by an *Ephemerides*, at what hour an Eclipse shall happen at some knowne place, whereof you are well informed of the longitude: Then must be obserued by an *Astrolabe*, or other Astronomicall instrument, at what hour this Eclipse begins at that place, whereof you would willingly know the longitude: If the Eclipse do begin in both places the selfe-same time, you may assure your selfe that these two places differ not in longitude: But if there be a difference in the time, then must there be a difference in the longitude, which to finde out, you may in this sort proceed: Take the lesser summe of houres out of the greater, and there will be remaining, either houres or minutes, or both: If there remaine houres, then multiplie the same by 15; if minutes, diuide the same by 4; (for in this account as we haue taught, 15 Degrees make an houre) and adde the difference so found vnto the longitude, if the Eclipse appeare there sooner: but if later, subtract it from the longitude formerlie knowne. If there remaine any minutes after the diuision, you must multiply those minutes by 15; and so shall ye haue the Minutes of Degrees. To explaine this the better, we will take this familiar example frō some of our later writers. The longitude of *Paris* was set downe by *Ptolomy*, to be 23 degrees; now we may be informed by an *Ephemerides*, that a certaine Eclipse of the Moone beginnes there 3 houres after midnight; out of this I would willingly learne the longitude of *Tubing* a towne in *Suettia*: In this towne I obserue by some Astronomicall instrument, at what houre the Eclipse there beginnes, which I finde to be at three of the clocke and 24 minutes after midnight. Then by the subtraction of the lesser number of time out of the greater, I finde the remainder to be 24 minutes, which diuided by 4, which makes one degree, the quotient will be 6. degrees: and that is the difference, which if you adde to the knowne longitude of *Paris* (because the Eclipse begins there sooner then at *Paris*) it wil amount to 29 degrees; whereby we may collect that the longitude of *Tubing* is 29. degrees. To this rule for the most part are squared all *Cosmographical*

Tables of longitude, but yet in this happen diuers errors: 1. Because oftentimes in the Artificer there wants diligence in obseruing the right houre and moment of the Eclipse. 2. The diuers Epacts and latitudes of the Moone are commonlie neglected; wherefore some haue thought it the best way (if it were to be hoped) that diuers exact Astronomers should at diuers places obserue the same Eclipse, & so by conferring together according to the former Rule, finde out the longitudes of those places. But exact Astronomers cannot be so easilie found in every citie, wherof we desire to know the longitudes; or if there were such, they keepe not alwaies such correspondencie in friendship; neither is an Eclipse of the Moone alwaies at command. Neuerthelesse, this way is not to be despised, because where better waies are wanting, we must content our selues with what we finde.

2. *By a Clocke, Watch, or Hour-glaſſe, to finde out the longitude of a place.*

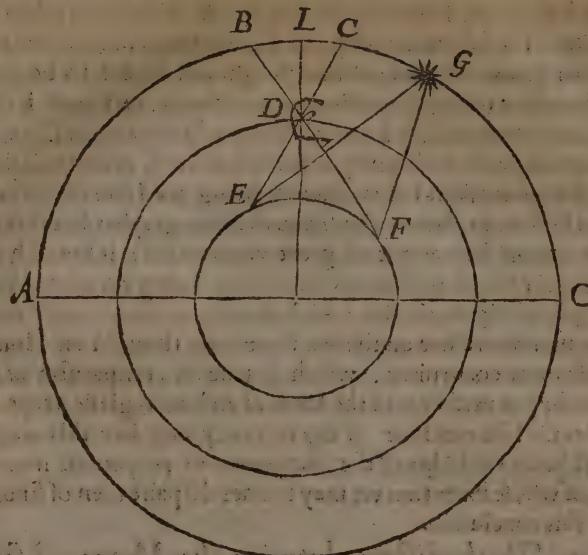
This conclusion is to be performed in this manner; You must get you a watch or clocke, apt to tunne (if you can) 24 houres; this watch must you, by the helpe of an *Aſtralabe*, rectifie and ſet iuft at ſuch time as you depart from the place where you are, as bound to any other place, wherof you desire to inquire the longitude: during which time, your diligent care must be to preſerue your watch in motion without intermission: being at laſt arrived at the place wherof you inquire the longitude, you were beſt to ſtay till ſuch time as the Index ſhall preſcilely point out ſome perfect houre. At the ſame iſtant it muſt be knowne by an *Aſtralabe*, what houre it is at the place where you are arrived; for if your *Aſtralabe* and *Watch* ſhould both agree in one, you might auſſure your ſelue that there is no diſference of longitude betwixt the place whence you came, and the place whereto you are arrived: For it is euident that in this ſort your iourney hath beene either directly North or directly South vnder the ſame Meridian. But if this diſfer either in houres or minutes, they muſt be reduced vnto degrees in ſuch ſort as we haue ſhewed in the former way. Through

which

which you may finde out the Longitude which you desire to know: This Invention is by our Countryman *Blundevill* acribbed to *Gemma Frisius*; although I should take it to be more ancient: but whose Invention soever it was, certainly it cannot but commend the Author. *Peter Martyr* in his Decades, seemes to preferre this way before all the rest; neuerthelesse in this I cannot assent to his opinion, being one I had rather trust as an Historian, then as a Iudicious Cosmographer: because the way cannot but admit of great vncertaintie: insomuch as a Watch or Clock will moue inæqually, being corrupted with rutt, especially on the Sea, which alwaies abounds with moist vapours: wherefore on the Sea, some haue thought an Hour-glasie more convenient, which is true in comparison of the Watch; but neither will the sands of an hour-glasie keepe alwaies the like motion: If any certainty may bee this way, it must be by the helpe of the *Automaton* or perpetuall moueable, of whose inuention we may sooner despaire then of finding out this conclusion.

3 *By the distance betwixt the Moone & some knowne Starre, which is situate neere the Eclipticke, the Longitude may be found out.*

This way was taught by *Appian*, illustrated by *Gemma Frisius* and *Blundevill*, to whose manner of explication, wee haue for farther illustration added a Figure of the Parallax whereon this Invention is grounded. First then to shew this conclusion, we must first lay this ground: that the Distances betwixt the Moone & other stars in the firmament are varied according to the difference of places: Insomuch as two men liuing farre distant in diuers places of the earth, beholding at one time the Moone and some other knowne fixt starre, will not finde the like distance betwixt them: whereof if any man doubt, he may be informed by this figure. We will imagine O to be the place of the Moone, as seated in the lower Orbe; G to be the place of the fixt starre, whose distance from the Moone is inquired: E and F two stations or habitations of men dwelling on the earth, whereof we may imagine the one to be in *Europe*, the



other in America: It will be manifest that the inhabitant situate in E will behold the Moone in the point B; and the said fixt starre in G: (because as the Optickes teach vs, all things are feene in the places opposite to the eye) so that the distance betwixt the Moone and the said starre, will be the Arch of the greatest Circle B G of the other side: the inhabitants situate in E, will behold the Moone by the ray E C in C: as likewise the said fixt starre G in the point G, by the ray E G: so that the distance betwixt the Moone and the fixt starre, will be in that station the Arch of the circle C G. Now by the first common Axiome of Euclide, every man must grant that the Arch of B G is greater then C G, the former being the whole, and this the part. Secondly, out of the same ground, wee may as easily collect that this distance betwixt the Moone and some other knowne fixt starre is varied proportionallie, according to the distances of the places on the earth, because so many places as there are, so many diversitie

uerisitie of aspects will arise, being increased or diminished, according to the distances of places on the Terrestriall Globe: This conclusion thus demonstrated, we must proceed to practise in this manner, as is taught by *Genesia Friesius*: First, it behoueth you to search out by the helpe of *Astronomicall Tables*, the true motion of the Moone, according to the Longitude, at that time of your obseruation at some certaine place, for whose *Meridian* the rootes of those Tables are calculated. 2. You must know the Degree of Longitude of some fixed starre, nigh vnto the Eclipticke, either preceding or following the mouing of the Moone. 3. You must seeke out the Distance of mouing of the Moone, and the said starre. 4. The distance once had, apply the crosse-staffe to your sight, and so mouue the Crosse to and fro, till you may behold the Center of the Moone, at the one ende, and the fixed starre with the other. So shall you see expressed by the Degrees and Minutes marked on the staffe the distance of the Moone and the said starre correspondent to the place of your obseruation: which being noted, set downe also the distance betwixt the Moone and the foresaid Starre which was first calculated. Then subtract the lesser from the greater, the residue will shew the least difference: which being diuided by the mouing which the Moon maketh in one hour you shall knowe the time in which the Moone is or was ioyned with the first distance of the foresaid starre. Then having conuerted that time into degrees and minuts, the rest will be performed either by addition or substraction of the Product thereof to or from that Meridian: for which the Tables where by you first calculated the motion of the Moone, were appointed and verified. If the distance betwixt the Moone and the fixt Starre of your obseruation be lesser, then must you adde the degrees and minutes to the knowne Latitude, so shall you finde the place of your obseruation to be more Eastward. If it be greater, then substract the degrees and minutes from the knowne Longitude, and the place of your obseruation in this regard will be more Westward. These rules are so farre true, that the Moone be supposed to bee more Westward then the

fixed Starre: for if otherwise, your working must be cleane contrary: to wit, if the distance betwixt the Moone and the fixed Starre be lesser, you must subtract the degrees and minutes from the knowne Longitude: so shall the place of your observation be more Westward: but if it be greater, then must you adde the degrees and minutes vnto the knowne Longitude, & the place of your obseruation shall be found Eastward. This way, though more difficult, may seeme better then all the rest: forasmuch as an Eclipse of the Moone seldome happens, and a watch, clock, orhoureglass cannot so well be preferued, or at least so well obserued in so long a voyage: whereas every night may seeme to giue occasion to this experiment: if so bee the ayre be freed from clowds, and the Moone shew her face aboue the Horizon.

4 *By the observation of the difference in the Sunnes and Moones motion, the Longitude of places may be found out.*

To explane this proposition, we will set downe three things. 1 Certaine Postulata, or granted Axioms. 2 The example. 3 The manner & practise: The grounds or propositions which we take as granted of all Mathematicians are these. 1 That the motion of the Moone is 48 minutes of an houre slower in 24 houres, or 360 degrees, then that of the Sunne. 2 That by obseruation of the heauens, and other Mathematicall helpe, an Artificer may know in any place first the Meridian: Secondly the houre of the day: Thirdly the time of the Moones comming to the Meridian. 3 The time of the Moones comming to the Meridian may be knowne by an Ephemerides: These things granted, wee will suppose for example, that in London the Moone on some set day comes to the Meridian at foure of the Clocke after Noone: 2 That in some part of the West Indies, the Moone be obserued to come to the Meridian the same day at 10 minutes after foure. These grounds thus set downe, the distance of Longitude of that place Westward from London may be found out. The manner of practise is thus to bee wrought

wrought by the golden Rule. If the difference of the Sunne & Moones motion be 48 minutes of an houre in 360 degrees, what will it be in 10 minutes? The fourth proportionall number will be 75 degrees, the distance of Longitude of the place assigned from *London*, in West Longitude; from which number the Longitude from *London* being subtracted, and the remainder from 360, the residue will shew the Longitude. If the Moone in the place assigned come sooner to the Meridian, we must count so much in East Latitude. This way I first found in M^r *Purchas* his relation of *Halls* discouery of *Groenland*, written by *William Baffin* since this Chapter came vnder the Presse: the expression of which, being as I suppose shorter and easier then in the Author, I doe owe for the most part to my worthy Chamberfellow, M^r *Nathanael Norrington*, to whose learned conference, I confess me to owe some fruits of my labours in this kinde, and all the offices of friendship. This manner of inuention, for mine owne part, I preferre before all the rest, both for certainty and facility: and (as it should seeme by *Baffins* practise) it is more in use amongst Marriners then the former, howsoeuer lesse mentioned amongst writers.

14. Thus much for the *Invention* of the Longitude: the *Expression* is the imitation of the Longitude on the face of an Artificiall Globe or Mapp; which is directed by these Rules.

1. *The place whereof we desire to knowe the Longitude being brought to the Brasen Meridian, the degrees of the Äquatour will shew the Longitude.*

This Rule may easily be explained by these three precepts. First that you must turne round the Globe on his Axell-tree, till you bring the place wherof seek the Longitude vnder the brasen Meridian. 2 You must diligently and exactly marke what degrees

degree the Meridian cuts in the *Æquator*. 3 You must number how many degrees that point is distant from the first Meridian, and the number will give you the true Longitude sought after. This also may be performed without turning of the Globe, if so be any other Meridian in the Globe signed out shall passe by the said place. For this Meridian will cut the *Æquator* in some degree or other, which being numbered, as before from the first Meridian, will shew the dire& Longitude: the like of which we haue in the second case.

2 *The Meridian running through any place of the Geographicall Table, will point and designe out in the *Æquator* the degrees of Longitude.*

This may easily be taught by the former way performed on the Globe: as for example, if I should inquire the Longitude of *Paris* the *Metropolis* of *France*, in a *Geographicall Mapp*, I finde a Meridian markt out which runs, if not directly through yet very neere the said City. This Meridian I trace along to the Southerne part, till I finde it to meet and cut the *Æquator*. Then obserue I in what degree of the *Æquator* it makes his intersection, and I finde it to be 23 degrees 20 minutes, which is the Longitude of the place.

15. Hauing spoken of the *Longitude*, the *Latitude* comes in the next place to be handled: the *Latitude* is the Distance of any place from the *Æquator*, either North or South.

What we haue spoken of the *Longitude* must also agree to the *Latitude*, that it is taken sometimes absolutely, and generally sometimes specially: in the former sense it signifies any distance or space betweene North and South, or contrariwise from South to North. Amongst the Ancients was the breadth or *Latitude* held to be about 80 degrees, so that the vtmost bound

bound or limit to it Northward was called *Thule*, which commonly is supposed to bee *Islands*. But the latter Navigators through their diligence haue detected so much land that it is found to stretch beyond 81 degrees toward the North, and 45 toward the South, and much farther if we will belieue the relation of *Ferdinand de Quir*, a Spaniard, who boasts a more ample discouery of the *South Indies*, then ever before hath beeene knowne. But howsoeuer, the Latitude here defined is taken in a more speciall and stricter sense for the distance of any place from the *Æquinoctiall line*, be it either toward the North or the South. The bound therefore from which we begin our account of Latitude is the *Æquatour*: but the subject wherein it is measured is the *Meridian*: so that it is cleane opposite to the *Longitude*, for that was limited by the *Meridian*, and measured in the *Æquatour*. The Latitude of a place is alwaies *æquall* to the *Elevation* of the *Pole*, as we shal shew hereafter, and is diuided into the *Northerne* and the *Southerne Latitude*, whereof the one is from the *Æquatour* Northward; the other Southward.

16. Concerning the Latitude are to be considered the *Inuention*, and the *Expressian*: the Inuention is againe twofold, *Astronomicall*, or *Magneticall*.

17. The *Astronomicall Inuention* of the Latitude is by the obseruation of the *Starkes*, which is directed by these Propositions.

The *Meridian Height of the Sunne at the time of the Equinoctiall* subtracted from 90 degrees, will shew the true Latitude of the place.

The height of the Sunne at *Noone* may be found by the *Astrolabe*, *Cross-Staffe*, *Quadrant*, and many other *Astronomicall Instruments*

instruments, but in taking the Meridian Altitude, it is very fit and requisite that it be obserued diuerse times one after another with some little space betwixt, to trie whether it increaseth or decreaseth; for if it doth increase, then assure your selfe it is not full Noone; if it decrease it is past Noone: hauing thus found out the Meridian Altitude, you must subduct it from 90 degrees, and the residue will bee the true Latitide of the place, if so be it be obserued at the time of the Equinoctiall, when the Sunne enters the first point of *Aries*, or *Libra*: as for example here at *Oxford* I obserue the Meridian height of the Sunne about the 11th of March, and I finde it to be about 37 degrees, or thereabout, which I subtract out of 90, the whole Quadrant, and the residue will be 52 $\frac{1}{2}$, which is the Latitide of the place: But if you would knowe the Latitide at any other day, or time of the yeare, then must you proceed in this manner: hauing taken the height of the Sunne at Noone (as before) you must by the Table of Declination learne the true degree of the Sunnes declination. 2 If such declination be Northernly, then must you subtract it from the foresaid Altitude or height. But if Southerly, you must adde it to the Altitude: and by such addition and subtraction, shall you haue the height of the *Æquinoctiall* above the Horizon. 3 This height of the *Æquinoctiall* aboule your Horizon, being as before substracted from 90, will be the true Latitide of the place assigued: as for example, the 15. of August I obserue the Declination of the Sunne to be about 10 Degrees, the Sunne being in 3 Degrees of *Virgo*: I finde the Meridian height of the Sunne to be 48 degrees or thereabouts. Now because the Sunne being in *Virgo*, hath a Northern Declination, I substract 10, which is the number of the declination, out of 48 the height of the Sun, and there will remaine 38, which againe taken out of 90, the residue will be about 52, the common receaued Latitide of the place.

2. *The Meridian height of any Starre, the Declination substracted, if it be Northernne, or added*

added if it be Southerne; being subtracted
out of 90, will shew at any time of the yeare
the Degrees of Latitude.

The former rule serues only for the day; because it is performed by the obseruation of the Sunne, but this latter may bee more necessary for Marriners, who now and then are inforsed to inquire the Latitude of a place in the night when the Sunne shines not: wherefore they must flie vnto some knowne Starre by obseruation of which they may easilie perorme the same; according to the rule: which differes nothing at all from that which we speake of the Sunne out of the Equinoctiall, and therefore need no other exposition then a bare example: let the fixt Starre you best knowe, be *Arcturus*, whose Meridian Altitude you finde by your Mathematicall Instrument to be 59 Degrees, and 30 minutes: then shall you learne by some Table that his Declination Northward is 21 degrees, 30 minutes: now because his declination is Northward, you must subtract it out of his Meridian Altitude, and you shall finde the remainder to be 52 Degrees, which is the Latitude for the place: as it is commonly taken, although I confesse it might be more exact: being obserued here at Oxford, be found rather 51 Degrees and 30 minutes.

18 The Magneticall Invention is performed by the Magneticall Inclinatorie Needle.

The ground of this Magneticall Invention is from the proportion betwixt the magneticall Inclinatorie Needle, and the Latitude of the Earth: for as we haue proued in the 13 Proposition of the 3 Chapter; the Magneticall Inclinatorie Needle wil at every point of Latitude conforme it selfe to certaine Angles with the Axell of the Earth proportionally to the Degrees of that Latitude: vpon which grounds Dr *Ridley* hath invented a curious instrument to finde out the Latitude for any place assigned, and for this vse hath calculated Tables, which wee hope will bee enlarged by our famous Professor Mr *Briggs*: for my part, haing never seene this Instrument,

or knowing the vse, I cannot enter on the description of it vntill such time as I shall haue occasion to acquaint my selfe with it.

19 The Expression is the imitation of it on the artificiall Spheare: which is againe either Astronomicall or Magneticall. The former is performed by the ordinary Globe according to this rule.

1 The point of any place or City first found in the Globe being brought to the brasen Meridian, will shew in the Degrees of the same Meridian the true Latitude of the same place.

This may easilly be shewed in this manner by an example; If I would willingly finde out the Latitude of Oxford in the Globe I first finde out the place in the Globe, which hauing found, I turne the Globe till I haue brought the place iust vnder the brasen Meridian: then I note what degree it designes, and that shewes me the true Latitude of the place, which I finde to bee 52, or thereabouts: but if you would finde it in a Mappe or Chart, in which there is no such brasen Meridian, you must take the Parallell of the place, or at least the next vnto it, pointed in the same Mappe: Then note what degree the said Parallel cuts in the first Meridian; for that will shew the true Latitude of it by the right Parallel of the place, if not the next; so that by addition, or subtraction, you may easilly guesse at it.

20 The Magneticall Expression depends from the Application of the Inclinatorie Needle to the Terrella.

The Magneticall inclinatorie Needle is said to conforme it selfe in the same manner to the Terrella or Loadstone, being artificially therewerto applied, as it doth to the great Globe of the Earth; so that no doubt is, but an imitation of the Latitude may

may be expressed on the little earth, or loadstone: for which vse, diuers curious instruments haue beeene devised by magnetical Philosophers, to whom I referre my Readers: because I (as I said) haue little acquainted my selfe with the vse of such instruments.

Of the distances of places compared one

with another.

Of the simple and absolute distinction of distances, we haue treated in the former Chapter: we must in the last place handle it *comparatiuely*; that is to say, one place compared with another: whereof we are to consider the *Inuention* and *Expres-
sion*.

2 The distance is the measured space betwixt two places: which is either *vniforme*, or *various*; *vniforme* is in places different, either in *Longitude* onely, or in *Latitude* onely.

3 Those places differ in *Longitude* only, which are situate vnder the same or like Parallels, but diuers *Meridians*, or at least vnder op-

posite pointes of the same Meridian.

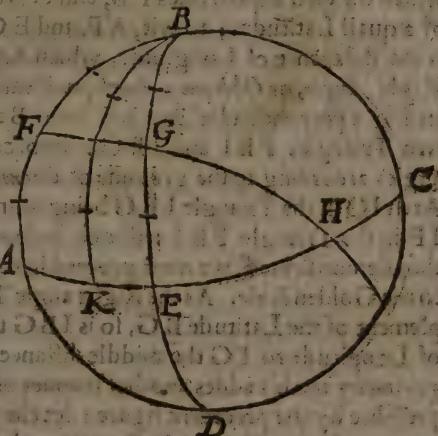
Of places differing only in Longitude, there may be three cases: For 1. they may be vnder the same Parallell, as the lland of Saint Thomas, and Summatra, which lie directly vnder the \textcircumflex equatour; or Noremburg and Hamberg, which having very neare the same Latitude, differ in Longitude, and lie in the same Parallell without the \textcircumflex equatour. 2. They may be vnder the like Paralels, that is, in points equidistant from the \textcircumflex equatour. As Siene in Egypt, vnder the Tropicke of Cancer; and Beach in the South continent, vnder the Tropicke of Capricorn. 3. They may be vnder the same Parallell and Meridian, but in opposite points of the said Parallell: such as are the Periæci, spoken of in the 10. Chapter.

4 Places differing only in Longitude, whose distance is here proposed to be sought out, are seated in the same, or diuers Hemispheres.

5 In the same Hemisphere, when both places haue either Easterne or Westerne longitude. This againe may haue two cases; for either the places are vnder the \textcircumflex equatour, or without it: in both which, the finding out of the distance shall bee opened in these Rules.

1 If two places vnder the \textcircumflex equatour in the same Hemisphere, differ in Longitude: let the lesser Longitude bee subtracted from the greater, and the difference conuerted into Miles, and the distance will be knowne.

As for example, we will suppose of two places, whose distance is to be sought out, the former to be the Iland of Saint Thomas in Africa, the other the Iland Summatra in the East Indies, both situate directly vnder the *Aequatour*; and therefore differing only in Longitude. To expresse which, in this figure, let the first Meridian from which the Longitude is to be measured, be A B C D: the place where Saint Thomas Iland is seated, K: and the place of Summatra, E. The A



subtracting A K, the Longitude of Saint Thomas Iland being less, out of the Longitude of Summatra. And when A E, the residue K E will shew the distance in degrees: which being multiplied by 60, and so converted into Italian miles, will shew how many miles the said places are distant the one from the other. As in this present example, we finde the Longitude of Saint Thomas Iland to be 32 degrees 20 minutes; of Summatra, to be 131 degrees: The lesser summe subducted from the greater; to wit, 32 degrees 20 minutes, out of 131; there will remaine 98 degrees 40 minutes; which being againe multiplied by 60, will produce 5920 Italian miles, the true distance betwixt the said places.

2. Of two places in the same Hemisphere, situat without the *Aequatour*; the distance may be knowne two wayes: either by the resolution of the Sphearicall Triangle, or else by tables

bles of the miles answerable to the degrees of
mire is *Latitude*.
The former way is performed in this manner: Let the Triangle
of two equall sides F B G in the figure before, be resolved; in
which the two equall sides F B, and G B are the complements
of equall Latitudes; to wit, A F, and E G. The Angle F B G
is the difference of Longitude, which Angle, whether it be a
Right Angle, or *Oblique Angle*, will easily be knowne, by
letting a perpendicular line B I from B to I it be parted into
two Triangles F B I and I B G: for because those two Tri-
angles according to the groundes of *Geometry* are equall; the
Arch I G is the Triangle I B G being found out, the Arch also
I F in the Triangle F B I will also be knowne; which being
thus demonstrated, we must proceed in this manner, according
to the Golden Rule. As the Right angle B I G is to the comple-
ment of the Latitude B G, so is I B G the middle difference
of Longitude to I G the middle distance: *Per ipsum in his Tri-
gonometry to this addes another manner of demonstration, ex-
pressible by the precedent figure: let the perpendicular I B be
continued vnto K, that B K may make a whole Quadrant.*
Now will the Triangle I H K haue Right Angles at I and K, at
I by supposition, at K by his 57 proposition demonstrated in
his first booke: because, *If a greater circle of the Spheare passe
by the Poles of a greater circle, it will cut it at right Angles, and
contrariwise*: wherefore the sides I H and K H must be Qua-
drants: because, as he shewes in his 68 proposition of his first
booke: *In a Spherical Triangle having more then one Right
Angle, the sides subtending those Right Angles are Quadrants:*
Finally, because the Arches G H and I H are the complements
of the Arches I G & K E: by the 9 definition of the first booke:
*Forasmuch as of any Arch less then a Quadrant, the complement
is that which wants to make it vp to 90 parts.* We may by the help
of the 57 proportion of his first booke, seeke out the comple-
ment of the third side G H: which will be the Arch G I: which will shew vs the probleme which we sought, by reduc-
ing

ducing it vnto the Table of Sines, and Tangentes, exactly set out by our forenamed Author and others. For an example of this, we may take two famous cities of *Germany*, *Noremberg* and *Hamberg*, which without any sensible difference haue the same *Latitude*, but differ in *Longitude*: For the Longitude of *Noremberg* is 31 degrees 45 minutes: of *Hamberg* 32 degrees 30 minutes: the difference of Longitude then is 1 degree 45 minutes. These things supposed to be knowne, we will imagine *Noremberg* to be in F, *Hamberg* in G: and therefore A F, or EG will haue 49 degrees 22 minutes: FB or GB will haue 40 degrees 37 minutes: FBG or AE will haue 9 degrees 45 minutes: KE 0 degrees 22½ minutes: EH 89 degrees 37½ minutes: if we worke by the Table of Sines Tangentes, and Secantes, the knowledge whereof is required to this Probleme. But because the former way may seeme difficult to such as are not much acquainted with *Trigonometry*, some haue set downe an easier way, depending on the vse of a Table, wherein is calculated the number of miles answering to euery degree of every Parallel of the Spheare: in which working, we ought to be directed by this Rule: *If two places without the Equator differ in longitude only, subtract the less number out of the greater, and multiply it by the number of miles answerable to a degree of that Parallel, and the product will give the distance.* As for example, if you would know the distance betwixt *London* and *Antwerpe*, which haue in a manner the same Latitude, but differ in Longitude: I finde them to differ in Longitude by 6 degrees, which number being multiplied by 37 miles answerable to 51 degrees of Latitude, these will arise to 247 miles, and 54 seconds of a mile.

A Table of Miles answerable to one Degree of every
severall Latitude.

	1	2	3
	D M S	D M S	D M S
1	59 59	16 57 41	52 52 26
2	59 58	17 57 23	52 50 53
3	59 55	18 57 4	33 50 19
4	59 51	19 56 4	34 49 45
5	59 4	20 56 23	35 49 9
6	59 40	21 56 1	36 48 32
7	59 33	22 55 38	37 47 55
8	59 25	23 55 14	38 47 17
9	59 16	24 54 49	39 46 38
10	59 5	25 54 23	40 45 58
11	58 54	26 53 6	41 45 17
12	58 41	27 53 28	42 44 35
13	58 2	28 52 59	43 43 53
14	58 13	29 52 29	44 43 10
15	57 57	30 51 58	45 42 26

4			5			6		
D	M	S	D	M	S	D	M	S
46	41	41	61	29	5	76	14	31
47	40	55	62	28	10	77	13	30
48	40	9	63	27	14	78	12	28
49	9	22	64	26	18	79	11	27
50	38	34	65	25	21	80	10	25
51	37	46	66	24	24	81	9	23
52	36	56	67	23	27	82	8	21
53	36	7	68	22	29	83	7	19
54	35	6	69	21	30	84	6	16
55	34	25	70	20	31	85	5	14
56	33	33	71	19	32	86	4	11
57	32	41	72	18	32	87	3	8
58	31	48	73	17	33	88	2	5
59	30	54	74	16	32	89	1	3
60	30	0	75	15	32	90	0	0

6 The distance of places differing onely in Longitude in diverse Hemispheres is found out by this rule.

I Let the greater Longitude be subtraeted from the whole circle, and vnto the residue added the lesser Longitude, there will arise the Distance betwixt those places.

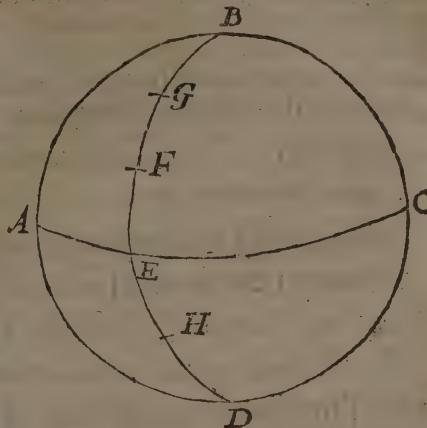
As for example, *Lisbone* in *Spaine* hath in East Longitude 13 degrees: and *Cape de Los Slavos* in *America*, hath in West Longitude 334 degrees: to knowe the distance betwixt those places, you must first subduct 334, which is the greater Longitude out of 360 the whole circle, and there will remaine 26 Degrees, to which if wee adde the East Longitude of *Lisbone*, which is 13 degrees, it will make 39 degrees, which is the true difference of those Longitudes: which being multiplied by the Number of miles in the Table going before, answerable to the Latitude of the said places (if they differ only in Longitude) there will arise the number of miles contained in the Distance.

7 Distant places vvhich differ only in Latitude, are such as lye vnder the same Meridian, but diverse Parallells: These are supposed to be either in One, or in Diverse Latitudes or Hemispheres.

8 In One, when both the places haue either North Latitude, or both South Latitude: The finding out of which distances depends on these Propositions.

I If the Latitude of each place be towards the same Pole, subtract the lesser from the greater Latitude, and the residue convert into miles.

The reason may be explained in this Figure: wee will imagine E F to be the lesser, E G the greater Latitude. There will remaine an Arch of the Meridian F G: which being multiplied by 60 (being part of a great circle, will make the number of miles answerable to that distance. For an example we will take two Cities of England, Oxford and Yorke.



The Latitude of Oxford, we take to be 51 degrees 30 minutes: of Yorke 54 degrees 30 minutes. The lesser Latitude subtracted from the greater, there will remaine three degrees, which being multiplied by 60, will render 180 Italian miles, the Distance of those two places.

2 If two places in Latitude only distant, be situated in diverse kindes of Latitude: adde the Latitude of the one to the other, and the whole summe shall be the distance.

As for example, in the former Diagram, imagining as in the former case B D to be the Meridian of those distant places, and A C the Aequator: we will suppose the one place to bee situated towards the North Pole, as in G; the other towards the South, as in H: then as appeares by sense, will the distance bee the Arch of the Meridian G H, whereof G E, and E H, are parts, whereof it is compounded; wherefore it must needs follow that those parts added together make the whole distance: for example we will take Bellograde in Europe, and the Cape of good hope in Africa, which haue neare the same Longitude, to

wit, 48 degrees 30 minutes: but they differ in Latitude in such sort, as the former hath of the Northerne Latitude 44 degrees 30 Minutes; the other of Southerne Latitude about 35 degrees 30 minutes. These two numbers added together, will make 80 degrees, which being multiplied by 60 will produce 4800 miles the distance of those places.

9 Hitherto of the distances of places which are *Vniforme*, that is to say, of such as differ either only in *Longitude*, or only in *Latitude*: we are next to consider of such distances as are *various*, wherein the places differ both in *Longitude* and *Latitude*.

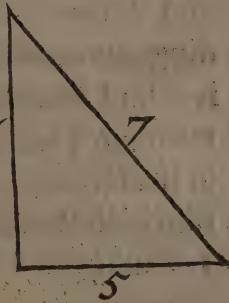
10 The Invention of such a distance, may be performed two waies, either *Abstractiue-ly* by the resolution of *Triangles*, or else *Mechanically* by Instruments. The former againe may be two waies, either by the *Right-line Triangle*, or by the *Sphærical*: The inuention of the distance by the *Right-line Triangle* depends on these following Propositions declaring two waies of Invention.

11 The first is by a *Rectangle Triangle* barely considered by it selfe: according to this Theoreme.

I *The square Root of the number made of the differences of Longitude and Latitude of two places*

places distant, will shew the distance of those places.

The ground of this Proposition is taken from the 27 Proposition of the first booke of *Euclide*: where it is demonstrated that the square of the Hypotenus, or greatest side of a Rectangle Triangle is æquall to the two squares made of the two other sides: which being well vnderstood, will lend an easie light to this proposition. To performe which we must first take the difference of Longitude, which is imagined to make one side of this Triangle. Then must we obserue also the Difference of Latitude, which is supposed to make another side. Then are we sure by the former Proposition of *Euclide* that the squares of these two sides, are æquall to the square of the Hypotenus, or third side; which is to be sought out, and expresses the distance betwixt those places: wherefore we must first multiply these two sides in themselves, whence they will become squares. 2 We must adde them together. 3 We must out of the totall extract the Quadrat root, which will shew the distance: as suppose according to this Figure, two Cities distant and differing both in Longitude and Latitude: whereof the one shall haue in Longitude 21 degrees, in Latitude 58: the other is supposed to haue in Longitude 26 degrees, in Latitude 52. Here first I subtract the lesse Longitude out of the greater, to wit, 21 out of 26, and the residue will be 5, which I suppose to be one side of the Rectangle Triangle. Then likewise I subtract the lesse Latitude as 52 out of 58, the residue will bee 6, which I make the other side of my Triangle, which done, I multiply 6 in it selfe, and it makes 36, which is the square of one side: Then I multiply 5 in it selfe, and the Product will be 25, the square on the other side. These two squares added together by the foresaid Proposition must be æquall to the square of the Hypotenus.



or third side 61, whereof the square root being extracted, will shew the side it selfe, which will be $7\frac{1}{2}$, which is the distance: If any man desire to knowe this distance according to Miles, he must reduce the degrees of Longitude and Latitude into miles according to our former rules, before he begin to work: because (as we haue shewed) the degrees of Longitude being measured in the Parallelles are not alwaies æquall, the Parallelles being somewhere greater, some where lesser. This way must needs be more exact, in that a Mile is a smaller part then a Degree, and (as *Pitiscus* notes) the Fractions which fall out in extraction of roots can hardly be reduced to any proportion. Neverthelesse this way of finding out the distance by a Right-line Triangle, howsoever common and receaued, is very vnperfect and subiect to great errore, especially in places far distant: forasmuch as it supposeth the Meridians with the Parallelles on the Globe to make true squares, whereas indeed all the Meridians meet in the Pole, and so by consequence cannot make true squares: But yet this errore is far leſſe in a lesser distance; because in a small ſpace of earth, the roundneſſe and conueniency of the Earth is insenſible, or at leaſt of very ſmall importance: So that this way cannot be altogether vnusefull.

12 Another is found out more exact then the former by the Tables of Sines, Tangents, and Secants. This is performed by finding out the numbers: whereof the former is called *Inventum primum*, or the first found number. The ſecond *Inventum Secundum*, or the ſecond found number. The working of which Probleme depends on these rules.

1 Multiply the Right Sine of the difference of the longitude into the ſumme of the complement of the leſſer latitude, and diuid the product

duct of that multiplication by the totall
summe, and then by the rules of Sines and
Tangents the Arch of that Quotient found
out will give the first found number.

2. Multiply the right sine of the lesser Latitude
by the totall sine, and having divided the
product thereof by the sine of the comple-
ment of the first number, subtract the Arch
of that quotient out of the greater Latitude
which gives the second found number.

3. Then multiply the sine of the comple-
ment of the first found number into the
sine of the complement of the second found
number, and having divided the product by
the Totall Sine. Let the Arch of the quotient
soealib be sought out by the Tables, which Arch
subtracted out of the whole quadrant, will
give the degrees of a distance in a great circle.

To expresse the practice and manner of working according
to our former Rules, we will suppose the two cities, whose
distance is heere sought out to be *Jerusalem* and *Normberge*
in *Germany*. *Jerusalem* hath in longitude 66. degrees, 0. minutes,
and in latitude 31 degrees, 40. minutes. Against *Normberge*
hath in longitude 28. degrees, 20. minutes, and in latitude 49
deg. 40. min. The difference of their longitude is 37. deg. 40.
minutes. The right sine whereof is 36 66. 45 (for here we make
60000. to be the total sine, rejecting the two last figures on
the right hand in the tables of *Regiomontanus*.) Now you

must multiply 36664: into the sine of the Complement of the lesser latitude, which is 51067: the product of which two sines being multiplied the one by the other, there will arise 1872320488: which if you diuide by the totall sine 60000, the quotient will give you 31205, whose Arch is 31 deg. 20 min. and this must be your first found Number.

For the finding of the second Number, you must proceede in this manner: Multiply the right sine of the lesser latitude, which is 31498 by the totall sine 60000, & the product will be 1889880000: which summe, if we diuide by the sine of the Complement of the first-found Number, which is 51249, we shall finde 4 the quotient 35876; the Arch whereof is 37 degrees, 55 min: which Arch subtracted out of the greater latitude, there will remaine 11 degrees, 29 min: and this is our second-found Number. These things thus supposed to be found out, we must multiply the fore-said sine of the Complement of the first-found Number, which is 58798, and the product will arise to 3013338703, the Arch whereof is 56 deg. 50 min: which being subtracted out of the whole quadrant, viz: 90 degrees, there will remaine 33 degrees, 10 min: of the greater circle. These 33 deg: if we multiply by 60, there will arise 1980 miles, whereunto if we finde the 10 miles, answerable to the 10 min: we shall finde the distance betwix these places to be 1990 Italian miles. This example is vsed by *Appian*, and wrought according to his owne Tables, and farther explained by our countfman *Blundevill* in his Exercises. The same way of working hath bin deliuered by *Clavis*, *Ulfius*, and others, altho not according to the same Tables: This way of measuring the distance by the Sines and Tangents according to these authors, may be warranted more exact than the other, because it adittis of smaller parts in the calculation, yet will it come far short of truth.

10. Another way of finding out the Distances of places, differing both in longitude and latitude, is by the Resolution of a

Sphæricall Triangle.

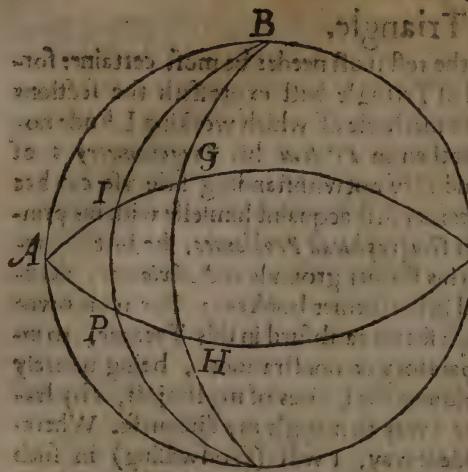
This way of all the rest must needs be most certaine: forasmuch as this kind of Triangle best expresseth the sections of the Globe. The methode of which working I finde nowhere better taught then in *Pitiscus* his *Trigonometry*: of whose ingenious industry notwithstanding little use can bee made, except the Learner first acquaint bindeleſſe with his principle, because in his *Geographicall Problemes*, he briefly referreſſes his Reader to his former grounds and *Axiomes*, accurately demonstrated in his former bookeſſes: For mine owne part it might perhaps ſeeme aſſ absurd in this Treatife, to intermixe all his preparatory demonstrations, being mereley Geometricall, and without the limites of my ſubject, as by leaſing out ſo neceſſary a way to mangle my diſcourse. Wherefore intending a middle way, I will (God willing) in ſuch ſort ſet downe theſe propositiōnes, that I may giue ſome light to this excellent Invention, and referre my Reader to *Pitiscus* his *Axiomes* for farther Demonſtration.

14. The Distances propoſed to be measured

by Sphæricall Triangles, admitt of two caſes: 1. When two places are ſo ſituate, that the one is vnder the *Æquator*, the other without. 2. Secondly, when both are without the *Æquator*.

15. The former againe is three fold: For either the diſference of longitude betwixt those places is *Æquall* to a quadrant, or *Lefſe*, or *Greater*. The ſeverall wayes of Invention ſhall be directed by theſe Rules.

I. If the Diſference of longitude be *Æquall* to a quadrant, the Diſtance will alſo be a quadrant.



of a Greater Circle BGD, by the 56 prop. of the 1 of *Pincem*: wherefore all the Arches drawne from thence to BGD will be quadrants by the same proposition. For a mo. e familiar instance we wil take the Iland *Symaria*, which hath in longitude 131 degrees, but no latitude, being situate vnder the *Æquator*: and the city *Buda* the *Metropolis* of *Hungary*, which hath in longitude 41 degrees, in latitude 47 degrees; The difference of longitude is 90 degrees; for 41 being subducted out of 131, there will remaine 90, wherefore the distance betwixt those places wilbe 90, which being multiplied by 60, will produce 5400 Italian miles.

If the difference of longitude be lesse then a quadrant as AF; the Triangle A E F here is to be resolved into his parts, according to the 4th Axiome of Pitiscus.

As for example the places whose longitude is heere sought
our, shall be A and F. The Triangle here to be known is A E F;
whose Resolution depends on our Authors. 4th Axiome. For

the Difference of longitude is A B F; because the measure of a Spherical Triangle being taken in a great circle, is an Arch of a greater circle, described from the Angular point, and comprehended betwixt the two legges of the Triangle so far as a quadrant, as is taught in the 58 proposition of his first Booke. For a more speciall instance we will take two places, whereof the one shall bee the Iland of S. Thomas before mentioned, which hath in longitude 32 degrees and 20 minutes. The other Amsterdam in Holland, which hath in longitude 26 degrees, 30 minutes. The former we imagine in A; the later in F. The Difference of longitude A B F will be 6 degrees, 50 min: Then the distance sought out must be A F: so working according to the fourth Axiome of *Priscus*, we shall find the Arch A F, which is the distance, to be 54 degrees, 19 minutes.

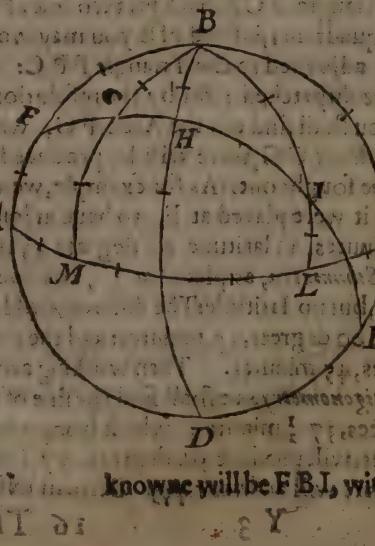
3. If the Difference of longitude be greater then a quadrant, as of the two places F and C, the Triangle to be resolved will be F C E, being a Rectangle at E.

Heere because the Triangle F C E hath his two sides F, C, and E C, greater then quadrants, instead of it you may worke on the Triangle I E F, adjoyned to the Triangle F E C: and the whole worke wilbe dispatched: for by the resolution of the Triangle A E F, you shall find out the Arch F G, which being added to the quadrant C G, there will be produced the Arch F C, which is to be sought out. As for example, we will imagine Heidelberg as it were placed at F, to haue in longitude 30 degrees, 45 minutes, in latitude 49 degrees 35 min: Then we will suppose Sumatra, as placed at C, to haue in longitude 131 degrees, but no latitude: The difference of longitude will be E C, of 100 degrees, 15 minutes: and the complement A E 79 degrees, 45 minutes. Then working according to the Rules of *Trigonometry*, we shall find the sine of the Arch F C, to be 6 degrees, 37 $\frac{1}{2}$ minutes; which being added to F C, being 90 degrees, will produce 96 degrees, 37 $\frac{1}{2}$ minutes, to which Arch there will answer 1449 German miles.

16 The second Case is, when both places are situate without the Æquatour: This is againe two-fold: For either the two places are ynderstood to be situate towards the same Pole, or else one place toward the Northerne, the other tovwards the Southerne Pole. Both vwhich Cases shalbe taught in these Rules.

I. If both places whose distance is sought, be situate towards the same Pole, there will arise a Triangle, whose sides and Angles will bee knowne by the fourth Axiome of Pitiscus in Trigonometry the fourth Booke.

As for example, in this present figure let the two places given bee F G, the triangle to be knowne, will be F B G, whose acute Angle will bee at B. Let the places given be as F H; the triangle to be resolved & knowne, will be F B H, having a right Angle at H. Finally, if the places given be as F I, the triangle to be knowne will be F B I, with an obtuse Angle at I.



If the one place be situated towards the North-pole, and the other towards the South-pole, there will arise a Triangle, whereof the one side about the Angle which is giuen, wilbe greater then a quadrant.

As in the former figure, let the places giuen be as G and K, also H and K, also I and K: There will still fall out a Triangle, whose one side containing the Angle giuen, wilbe greater then a quadrant, as BK: wherefore for the side BK, you must take his complement to the Semi-circle BF; that is, for the Triangle GBK, you must worke by the Triangle GBF: and instead of the Triangle H BK, you must take the Triangle HBF: and for the Triangle I BK, you must worke by the Triangle IBF, according to the fourth Axiome of the fourth booke of *Pitiscm*, to which I had fatter referre my Reader, then intermixe our *Geographical* discourse with handling the Principles of *Geometry*, which heere are to be supposed so many precedent propositions; which, expressed as they ought, would transcend the bounds of my intended journey.

17 Of the *Abstractive* vway of finding out the Distance of places, vys haue spoken: The Mechanicall depends on the vse of Instruments & Mechanicall operation, vwhereof vwill shew vone vway in this Theorem.

18 By the working with a Semi-circle, the Distance of two places may be found out: This Invention by M. Blundevill, seemes to be ascribed to Edward Wright, yet hath it bin taken vp of lateigne Writers as their owne, and vsed in their Charts and Mappes. The manner of operation is thus: First, let there be drawne a Semi-circle

circle vpon a right Diameter signed out, will be the letters A B C D, whereof D shall be the center, as you find it deciphered in this present figure. The greater this *Semi-circle* bee made, so much the more easie will be the operation; because the degrees wil be larger. Then this *Semi-circle* being drawn, and accordingly diuided, imagine that by the helpe of it, you desire to find out the distance betwixt *London* and *Jerusalem*, which cities are knowne to differ both in *longitude* and *latitudes*. Now, that the true distance betwixt these two places may be found out, you must first subtract the *lesser longitude* out of the *greater*, so shall you finde the Difference of their longitudes, which is 47 degrees. Then reckon that Difference vpon the *Semi-circle*, beginning at A, and so proceed to B; and at the end of that Difference, make a marke with the letter E, into which point by your Ruler; let a right line be drawne from D the center of the *Semi-circle*. This being in this sorte performed; let the *lesser latitude* be sought out, which is 32 degrees in the foresaid *Semi-circle*, beginning your account from the point E, and so proceeding towards B, and at the end of the *lesser latitude*, let another point be marked out with the letter G: from which point let there be drawne a perpendicular, which may fall with right Angles vpon the former line, drawne from D to E; and where it chaneeth to fall, there marke out a point with the letter H. This being performed, let the *greater latitude*, which is 50 degrees, 32 minutes, be sought out in the *Semi-circle*, beginning to reckon from A towards B, and at the end of that latitude set downe another point, signed out by the letter I: from whence let there be drawne another perpendicular line, that may fall with right Angles vpon the *Diameter* A C, and here marke out a point with the letter K. This done, take with your *Compass* the distance betwixt K and H, which distance you must set down vpon the *Diameter* A C, placing the one foote of your *Compass* vpon K, and the other towards the center D; and there marke out a point with the letter L. Then with your compass take the shorter perpendicular line G H, and apply that widenesse vpon the longer perpendicular line I K, placing the

Edward Foster his Book

Born February the 28
anno domini 1739

Whose Book I am if you
would know in letters too
I will show the one is F. F.
great of might the
at the F. in all mains sight as
if you chance to offend ~~it~~
ome so look up above and
there it is



GEOGRAPHY THE SECOND BOOKE.

CONTAINING THE GENERALL
Topicall part thereof.

By NATHANIEL CARPENTER
Fellow of Exeter Colledge
in Oxford.

GENES. I. ver. 10.

And God called the Dry-land, Earth ; and the gathering
together of the waters called he Seas: and
God saw that it was good.



OXFORD,
Printed by JOHN LICHFIELD and WILLIAM
TURNER, Printers to the famous University,
for HENRY Cripps. An. Dom. 1625.

Edward Foster His Book
Born October the 22 1761

Edward Foster is a good man
He reads his books and studies
With a great deal of care and more
He writes well and reads to
his friends

150

Edward Foster is a good man
He reads his books and studies
With a great deal of care and more
He writes well and reads to
his friends



TO THE RIGHT
HONOURABLE
PHILIP,

EARLE OF MONTGOMERY

etc: Knight of the most Noble

order of the Garter, & Standard

of the famous Univer-

sity of Oxford.

Right Honourable,

His Geographicall Treatise
consisting of two parts, was
in the very birth in such sort
consecrated to your inesti-
mable Brother, as notwith-
standing it so farre reserv-
ed it selfe, to awaite your Honour's favour, that
Both may beeke, as to share a part, to to
chal-

THE EPISTLE

challenge the whole in my poore Industrie. The Soule of man which some Philosophers imagine, to be *all in all*, and *all in euery part*, seemes to me no where better resembled then in your Generous Fraternity; wherein the Soule of Hericall Magnificence, though Indiuided in it selfe, so entirely communicates her selfe to either, that both may seeme at once to enjoy her presence, while neither want. If this my bold attempt in presenting to your Honours hands these vnworthy labours, without any former reference, might be interpreted intrusion, it were enough for Ingenuity to pretend, that your generous loue vnto our poore Colledge and the respectiue dutie wherein the Colledge alwayes stands obliged vnto your Honour, commands my penne beyond manners or ability. Your affection to our house, could no way expresse it selfe ampler, then by trusting our custody, with the charge of *R. L^d. D.* your choicest Lewell. A Gentleman of that towardly wit and sweete disposition, that Learning and Morality commonly reputed the daughters of time, seeme in him scarce beholding to yeares, and to challenge a precedency before

DEDICATOR.

Before experience; insomuch that our ancient Mother markt out with all the Characters of age and declining *weakenesse*, cherishing in her bosome this yong darling, seemes to resume her *youthfull* habit, and triumph ouer *Time* and *Ruines*. This happines amongst diuerse others vouchsafed by your Honor to the place, for whose good opinion the best part of mine endevours stand engaged, hath encouraged my *hopes* to promise me your indulgent Acceptance of this slender piece, long since intended and devoted, as my selfe, vnto your seruice: In which confidence, fearing any longer to trespassse on your serious and high imployments *endeighted* to your King and Countrey, I humbly rest

*Your Honour's in all duty and
seruice to be commanded*

NATHANIEL CARPENTER.

Wheat, Barley, and Oats

CHAPTER 20. *GRANITE*

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**

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dry

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I hev took this Crou
So I do I know

I haue it fine
to rise

1770



GEOGRAPHIE: THE SECOND BOOKE.

C H A P. I.

Of Topographie and the nature of a
place.

IN the former Treatise, by
Gods assistance, we haue
treated of the Sphaericall
part of *Geographie*: It will
in the second place seeme
conuenient to speake of
the *Topicall* part of it.

2 The *Topicall* part teacheth the description
of the *Terrestriall* Globe, so farre forth as it
is diuided into places.

The nature of *Topographie*, whereof we are to treat in this sec-
ond part, is discouered vnto vs, not only in the name, which
promiseth a description of places; but also in the differences
set down by *Ptolomey* himselfe, betwixt the *Sphaericall* and *To-
picall* part: the former of which he calles *Geographie*, and the lat-

2. **GEOGRAPHIE, The second booke.**

ter *Topographie*; whereof we haue spoken at large in the first Chapter of our former booke. Here onely we will note this one distinction, that *Topographie* may be taken either more generally, or specially: Generally we may take it so farre foorth, as it discouers vnto vs either, the whole world and all his parts, or at least some great and principall parts; such as is an *Empire, Region, Kingdome*, or such like. More specially and particularly, it hath vsually beeene taken for the description of a very small place, whose situation in respect of the heauens is not noted, but of the parts one to the other: such as are *Cities, Burromes, Townes, Castles, Lakes, and Rivers*. The former (whereat we chiefly aime) cannot well be performed without the vse of the *Sphericall* part: The latter we will more sparingly touch, being an infinite taske in the whole earth to descend to all particulars which come in our way: yet shall we not altogether omit or neglect such circumstances in their due places, so farre foorth as we can; leauing the rest to such *Topographers*, who spend their stocke in the description of some particular place or Region: whereof this our Age hath produced many deseruing high commendations. This Science was anciently adorned by *Homer, Anaximander, Milesius, Hecataeus, Democritus, Eudoxus, Dicaearchus, Euphorus*, as we finde in *Straboes* first booke: to which afterward succeede, *Eratosthenes, Polibius, Posidoniuss*, and diuers others. Which part requires little or small knowledge in the Sciences *Mathematicall*, but challengeth more affinity with the *Physical* and *Politicall* part of *Philosophie*; and therefore is more subiect to popular vnderstanding then the former, and may without it, affoord some profit to the Reader.

3. The *Topicall* part is either generall, or speciall: The generall is that which handles the generall Adiuncts of a place.

4. A place is a superficiall space of the Terrestriall Globe, fitted for habitation.

C H A P. I. 3

To the constitution of a place (as it is here *Topographically* taken) there ought to be a concurrence of two things, which we may call Matter and Forme. The Matter is the space contained; or superficiall platforme of the earth whereon we dwell. The forme is the capability or aptnesse of it for habitation; both which concurring together are conceiued to make a place, such as we here *Topographically* vnderstand: for here we vnderstand not a place *Physically*, for the receptacle of a naturall body; in which sens: the Heauens and all the elements are said to haue their naturall places: Neither yet *Geometrically* for a plaine whereon a line or figure may be drawne: but *Topographically* for the vpper face of the earth whereon people or other liuing creatures may inhabite. This place as appeares by reason and holy Scriptures was more ancient then habitation. For wheras in the first Massie the earth was inueloped with waters on every side, affording no place for dwelling; Almighty God is said afterwards to haue seperated and parted the waters from the dry land, making the one a Recepracle for Fishes, & such creatures of the deep, the other for a dwelling place for mankind, and such creatures as breathe vpon the land: yet hath he so prouided in his diuine wisdome, that neither the Inhabitants of the land can well want the Sea, nor the liuing creatures in the Sea want the land. The one appeares in that we are inforced to make vse of the sea, not onely for food and nourishment, whereof a great part consisteth of fish: but also for our Traffique and commerce with forraigne Nations, which is better effected by Sea then Land-voiages. The latter is as easily shewed, in that the fishes of the Sea deriuе not only their composition, but also their proper nourishment from the land: wherof we shall haue more occasion to speake hereafter. Now we are moreuer to consider, that a *place* may be taken in a double sense: first more largely for any place wherein a creature may liue for longer or shorter time. Secondly, more strictly for such a space of earth, whereon mankinde may conueniently reside or dwell. The former comprehends not onely the land, but also the water; for experience shewes, that men in ships may for a time reside and dwell on the backe

of the maine Ocean. But the latter betokening a continuance of habitation, is onely agreeable to the land: Which sense howbeit it be more consonant to the common vse of speech, yet for methode sake, weare inforced to vs the former: vnderstanding by habitation, not onely a place of conuenient resi-
dence, but any other whereon a creature for a time may breathe
and live.

I *The Terrestriall Sphere is euery webre habi-
table.*

It was an ancient opinion (as we haue formerly touched) that the earth was not euery where habitable:namely,in the *Intem-
perate Zones*, whereof the one was placed in the middle of the earth, the other at the endes : the former was thought not habitable by reason of the extremity of heat; because the Sun-beames there fall perpendicularly, and so make a greater reflection: The other for extremity of cold, by reason of the obliquity of the Sun-beames, causing little or no reflection: whence a second cause seemes to be drawne from the extreame drought of those places, which seemes most opposite to mans temper, requiring a reasonable degree of moisture. But notwithstanding these reasons of the ancients, it must needes be confessed as an vndoubted, truth confirmed by experiance of many Nauigatours, that those Regions by them imagined vnsit for habitation, are not onely habitable, but in many places very populous. Neither want there many reasons found out by latter writers, to mittigate the rigour of this opinion: some whereof we haue already touched in our former treatise. First, whereas they vrge the places vnder the *Æquinoctiall* to be vnhabitable by reason of intemperate heat; we may easily answier, that the dayes and nights are then alwayes *æqua*ll, containing not aboue 12 hours, so that the space of ei-
ther being shorter, the cold of the night may well asswage the extreame heat of the day. Another reason is ordinarily taken from the extraordinarily high mountaines, commonly placed vnder the *Æquinoctiall*, which approaching neerer the middle Region of the aire, must of necessity partake somewhat more

of cold: which daily experience can witnesse, in that their tops are couered with snow euē in the depth of Summer. Thirdly, the neerenesse of the maine *Ocean* to a great part of this Region, is a great cause of this cold temper, because water is found to be by nature cold. Fourthly, the set and certaine windes by nature ordained to blow in the hottest times of the yeare, may adde much to temperature. Fifthly, the extraordinary Raines & showers which those places suffer, which are vnder the Line, especially when the Sunne is verticall, are a great cause of the asswaging of the heat of the Sunne. Lastly, the custome of the Inhabitants being from their cradles inured to no other quality or disposition of the ayre, will take away much from our admiration. On the other side no small reasons may be shewed, why the Regions lying neere or vnder the *Pole* should not be so extremely cold, but that they may admit of habitation. First, because the Sunne being for six moneths together aboue their Horizon, must needs impresse into the Ayre more heat then otherwise it would doe. Besides, the thicknesse incorporated (as it were) with heat, must needs receaue into it more degrees of it then a thinner and more refined ayre, because the intention of the quality most commonly supposeth the condensation or thickning of the subiect wherein it is. But no greater reason can be shewed in this point then the custome of the Northerne inhabitants, expo'd from their infancy to no other temperament. If we should aske a reason why we vnmask our faces against the encounter of the greatest cold, being a soft and tender part, not daring to vncouer our other parts, what reason can a man inuent but custome? If any should aske why barbarous people liuing in farre col'der climates then this of ours, goe altogether naked, whereas the cold is mother of many diseases amongst vs who goe alwaies clothed; only vse and custome can yeeld an answere. These reasons make it probable enough, that no place of the whole world is by nature made not habitable. Now that it is not onely inhabitable by nature, but also for the most part truely inhabited, will appeare as easily, if we trust the testimony of Navigatours which haue discouered few or no Regions wan-

ting some Inhabitants. But that this proposition may be more distinctly vnderstood, we must knowe that the whole world is divided into *Sea* and *Land* for the *Sea* we may call it habitable in that large sense before mentioned; to wit, that on it euery where men in shippes may breath and liue; which is plaine out of experiance of *Nauigatours*, who haue sailed round about the Earth from *East* to *West*, and haue entred farre towards the *North* and *South*: where at least some times of the yeare, or other they might finde the way passable: For the land which is here principally vnderstood, wee must note that it may bee considered two waies; either for every little quillet or parcell of land contained in the superficies of the Earth; or else for a certaine Region of some indifferent greatnesse. In the former sense, it were too much to affirme every part of the Earth to be habitable; forasmuch as many places, as the toppes of the *Alpes*, or the sands of *Africa*, properly admit of no habitation; yet in an improper & large sense they may be called habitable, because on them a man may liue and breath for a certaine space of time. But if by the parts of the land wee vnderstand some reasonable greatnesse, no great doubt can bee made, but that it is either already inhabited by mankinde, or can at least admit of habitation, as that which not only for a time affords a man life and breath, but also some conuenient meanes of sustenance; for no country hath euer beeene found so indigent & barren of all vitall aides, which is neither capeable of living creatures in the land, fit for mans nourishment; or that cannot drawe *Fishes* from the *Sea*; or if this should faile, cannot afford *Fruits* or *Herbage* from the ground: or in case all the rest were deficient cannot haue passage by *Water* to other Countries, whence to relieue their necessities. And no question but nature hath stored every Country with some commodity or other which by trafficke may drawe riches from other Regions, as by instances may more particularly appeare hereafter when we shall speake of particular Regions, and their seuerall accidents.

2. *All places of the Earth haue suffered mani-*

fold

fold alteration and change as well in Name
as Nature.

I need not spend time to demonstrate this Assertion, for that euery place of the Earth hath beeene subiect to much mutation in the processe of time, as well in Nature of the *Soyle* as of the *Inhabitants*, a few obvious instances in each Country will easily certifie: yet will it not seeme amisse, I hope, to shew the progresse, manner, and causes of this alteration, which would giue no small satisfaction. To discourse of all changes according to all times were a matter infinite: We may referre all to two heads, to wit, the change of *Names*, and the change of *Nature*. Concerning the former that most Countries haue changed their first and originall names, is most evident to such as consult the Maps and writings of our common Geographers: for few or none will discouer vnto vs any Region by that name, by which it was knowne in former times: insomuch, as great controuersie & dispute hath grown about diuerse countries mentioned by ancient writers, whereof the name should take its first originall; but of this change we shal speak hereafter. But if we consider the natural changes of Countries sithence the first creation wee shall finde them to haue suffered as well in the naturall accidents, and disposition of the soile, as the temper of the *Inhabitants*; concerning the former we may note a twofold alteration; whereof the one is a progresse from *Imperfection* to *Perfection*; the other contrariwise, from *Perfection* to *Imperfection*. The first groweth out of the generall Industrie of mankind, which is wont to worke euery thing as neere as it can to h's best ends and vse, for his owne good and propagation of his kinde: which we may best finde in the first originall of the world, the first ground work of ciuill societie; for man being once expelled out of *Paradise* for his owne transgression, had left him notwithstanding for his lot the whole worl'd b. sides, which no question he found as in the cradle of Nature a p.ore infant, as yet altogether vnfashioned and vnshaped for humane habitation. For who can imagine the earth at that time to be any otherwise then as a vast Wildernes all ouergrownne

ouergrown with briers and bushes growing of their owne accord out of the Earth: Moreouer what *Fennes*, *Bogges*, *Marshes*, and other such incombrances could there be wanting to those places which never yet felt the chastising hand of husbandrie? All these incommodities, as mankind began to multiply & propagate it selfe on the face of the Earth, were by little & little remoued, and the Earth reduced into a better forme for humane dwelling: because every man choosing out his owne possession, began presently to till & manure the soyle with all heedfull industrie. For if our first Parents being placed in *Paradise* it selfe, the most pleasant & fertile portion of the whole world, were neverthelesse enioyned to dresse and manure the Garden for their better vse and profit, what shall we imagine of the other parts of the Earth, which (no doubt) a thousand degrees come short of this perfection: especially knowing this curse to bee laid on man by our Creatour: *That he should eat his bread in the sweat of his browes*; as though the earth were bound to open her treasures onely to mans paines and labour. And howsoeuer the diligence of mankind hath gone very far in adorning and fashioning the vpper face of the earth, yet hath it not waded so farre, but that many places in our times are left altogether rude and vncultered, groaning vnder vast Wildernesses and vnprofitable desarts. For times past we might haue for instance, gone no farther then *Britanie* and *Germanie*; both which Countries we shall finde in these daies to differ as much from the daies of *Casar*, as *Casar* iudged them to differ from the *Romane* Territory; which no doubt he preferred before all parts of *Europe*. Notwithstanding this generall inclination of mankind to perfect their dwelling places for their better ease and comfort, we shall finde many waies whereby the parts of the Earth haue degenerated, & proued more unfit for humane habitation then in former times. The first which is the greatest, and cause of all the rest, is that *Curse* which our Almighty Creatour cast on the whole Earth for *Adams* sake, which afterward seemes renued and increased in the generall deluge, wherein all mankind suffered for their sinnes a plague of waters. For as the estate of mankind immediatly before the *Flood*

Was

was farre better then that afterwards, so was the estate of *Paradise* farre better then that : So as wee may note from the beginning of the world a generall defect and weaknesse of the Creatures, still more and more declining from their originall perfection granted in the first creation. So that many great Philosophers haue conieclured, not without ground, that the world from the first creation hath suffered the change of ages sensibly, and this wherein we liue to bee the last and decrepitate age, wherein Nature lieth languishing, as ready to breath out her last. But this opinion seemes to be controled by reason; forasmuch as we finde not a proportionall decrement and defect of naturall vigour in things, as well in man as other creatures. For if we compare the estate of a man before the Flood, with the age of *David* long after, we shall finde a great disparity in the proportionall decrement of the *Yeares* and *Ages* of men: forasmuch as many before the Flood attained to 800, & some as *Methusalem*, to 900 yeares: But in *Davids* time, the daies of mans life (as he himselfe testifieth) are threescore and ten: & admit we vnderstand this speech of *David* to be meant onely of his chieffest strength and liuelihood, we shal yet finde a great diuersity, because man is vnderstood to bee in his greatest strength and vigour in his middle age; so that the whole age of man by this account surmounts not 140 yeares. To which proportion of defect or decremet our times can no way agree, because many men in our daies come neere the same age, as we see by experience, which may be confirmed by diuers instances, whereof we will produce only two: the one of a certaine *Indian* presented to *Soliman the Turke*; being of the age of 200 yeares: the other of the Countesse of *Desmond* in *Ireland* (which *S. Walter Rauleigh* mentiones to this purpose) who was married in *Edward* the fourth's time, yet was aliue very lately. But to this doubt I might answere, that this extraordinary difference betwixt the ages of men, between the *Patriarchs* & *Davids* time compared with men, ages betwixt *Davids* and our daies, came from two especiall causes: First by the vniuersall *Deluge*, which caused a generall defect and decay of nature in the whole earth, the like whereof hath not since bin found:

Secondly, it was (as it seemes) much impaired by the *Intemperance* and luxurious diet of those times, which added much to this generall weaknesse of nature: forasmuch as the children can haue little or no naturall perfection in themselues more then is deriuied vnto them by their parents. For nothing can giue that to others which it never had it selfe; whence it must needs come to passe, that the posteritie deriuied from luxurious and distempered bodies, shoule proue as weake and impotent generally (if not more) then their Parents. Now why the people soone vpon the Flood should finde their distemperature more noxious and prejudiciale to long life then the men of our age, a good reason may be giuen; because the Earth long after the Flood had not fully receaued that naturall heat & spirit which it lost in the *Deluge*. So that all things arising out of it; as *Plants, Hearbs, Fruits*, and liuing creatures feeding thereon, proued for a while more vnwholsome and vnnaturall, then in some yeares after, when it had somewhat reviued it selfe by the heat of the *Sunne* and the *Starres*, & by little & little returned to his owne nature. The other cause of deficiencie is more speciaall, as not happening to all, but to diuerse parts of the Earth, and that more at one time then another: as the negle^ct of due manuring many places, caused commonly two waies; either by contagion naturally incident to diuerse places, or by hostile *Invasion* and devaſtation: of this latter arise two maine effects; The first is the want and scarcity of Inhabitants, which should dresse and manure the ground to make it more fruitfull and accommodate to mans vſe. The second is their *poverty* and *captivity*; whereof the one makes them vnable, the second vnwilling to effect any great matter for the benefit of the Land. A good instance whereof we may finde in the land of *Paleſtine*; which in times past by God himſelfe was called, *A land flowing with milke and hony*, for the admirable pleasantnesse & fertilitie of the Soile: yet at this day, if wee will credit trauellers report, a most barren Region, deuoid almoſt of all good commodity fit for the vſe of man; in the ruines of which ſometimes famous kingdome, every bleare-eied judgement may eaſily read Gods curse long ſince denounced: Which ſtrange al-

teration

teration next vnto Gods anger we can ascribe to no other cause then the hostile invasion of torraine enimies, which hath almost left the land waste without the natuue Inhabitants; whence it could not chuse in a short time but degenerate from the ancient fruitfulness. The like may we finde in all those miserable Regions which groane at this day vnder the tyrranie of the v-surping Turke: whence a prouerbe runnes currant amongst them: *That where the Turkes horse hath once grazed, no grasse will ever after grow:* which signifies no other then the barbarous manner of the Turkes, hauing once conquered a land, to laie it open euer after to deuastation: for being for the most part warlike men trained vp in martiall discipline, they little or nothing at all regard the vse of husbandrie: whence in short time a Countrie must needs turne wild and vnfruitfull. To these causes we may adde the influence of heauenly constellations, which being varied according to the times, produce no small effects in the changes and alterations of the Earth. The diuise alteration in the disposition of the Inhabitants which was our second point, we haue referued to another place neare the end of this tract, to which it properly appertaines.

3 *Places hauing long continued without habitation are seldome so healthie and fit for dwelling as those which haue beeene inhabited.*

This Proposition I haue knowne to be warranted by the Testimoni of many experienced Nauigators: insomuch as I presume few men can doubt of the truth of it, which hath either beeene a Traueller himselfe into farre Countries, or at least hath read other mens discoueries. The onely matter therefore wee here intend, is to produce certaine causes of this effect, to giue satisfaction to such as make a distinction betwixt the knowledge of the effect, and inquiry of the cause. The first cause which I can al'eage is the industrie of mankind inhabiting any Countrie (mentioned in the former Theorem) out of which ariseth a two-fold effect. 1 The improuing of the Soyle, by remouing all such impediments as otherwise would proue noisome to mankind, for whereas all things growing of their

owne accord, are suffered to rot into the ground in like manner, what other can we expect but Fennes, Fogges, & noisome vapours, altogether hurtfull to the welfare and life of man. 2 The profit of mans industrie is no lese apparent in manuring the ground, & opening the vpper face of the Earth; which being composed of diuerse substances, sendeth forth many times certaine hot fumes and vapours, which in many cold Countries mollifie the vsuall rigour of the Aire, which most offendeth the Inhabitants. This reason is giuen by my Countriaman Captaine *Whitborne* for the extreame cold, which some men professe themselues to haue tried in *New-found-land*, which neuerthelesse, according to many mens description, is knowne to lye farre more South then *England*: for the natives of the Country being for the most part driuen into the North part by the *Europeans*, who vsually trade there for fish, and they themselues living altogether on Fish from the Sea, or some wild beasts on the land, as *Beares*, *Deare*, and such like; without any manuring of the ground for herbage; The Soyle by them is in a maner left altogether vnmanured: so that neither the soyle can be well cleansed from noisome vapours arising from the putrefaction of herbage rotting (as I said) into the ground, or left free to send out such wholesome fumes and vapours from its interiour parts, which may warme the Ayre, and preserue mankind. 3 A third reason drawn from mens Industries, that those Countries which haue injoyed Inhabitants by the continuall vse of *Fires*, haue their Aire more purged and refined from drossie and noisome vapours, which vsually arise out of a contagious soyle, daily infected by putrefaction: for scarce any nation hath beene knowne so barbarous & ignorant which hath not the inuention and vse of Fire: neither is any infection of the aire so pestilent, and opposite to humane constitution, which the breath of fire will not in some sort dispell. If any man obiect the distance of houses & villages wherin fire is vsed, which seeme to claime a small interest in the change of the ayre hanging ouer a whole Country: let him well consider the quicknesse of motion and fluidity of the Ayre, passing (as it were), in a moment from one place to the other, and he may

soone

soone answere his owne obiection. All those reasons hetherto mentioned an inhabited Region owes to mans industrie, which we generally touched in the precedent Theoreme. The second cause which is as a consequent of habitation, is the necessitie of breathing of people living in any Region of the Earth: whereby may follow two effects. 1 A certaine measure of heat imprest into the aire, as we see in any roome in a great throng of people, by reason of their breathing together in one place. 2 The assimilation of the Aire to humane bodies, by a continuall respiration. These alterations of the aire, might perhaps to common apprehensions, seeme small and insensible. But hee that considers how great a quantitie of aire is requisite for a mans respiration, and the space and extent of motion together with the multitude of Inhabitants in a populous Countrie, would hold it no strange matter, that the breathing of men should breed such an alteration of the aire: we finde by experience, that strong built houses being left tenantlesse, wil soone fall into decay, not so much for want of reparation, as the foggy vapours and moisture, caused by want of Respiration. The like whereof in some proportion may we imagine to be in a region wanting Inhabitants, and deprived of this benefit of nature.

C H A P. II.

Of the Generall Adjuncts of Places:

1. **N**a place Topographically taken, two things are to be considered. 1 The Adjuncts. 2 The Descriptions. The Adjuncts are such proprieties as agree to speciall places.

2. Such

- 2 Such Adiuncts agree to a place, either in respect of the Earth it selfe, or in respect of the Heavens: Those which agree to a place in respect of the Earth, are either *Internall*, or *Externall*.
- 3 The Internall I call such as are inbred in the Earth it selfe: which are of two sorts; either *Common*, or *Magneticall*.
- 4 The Common are in number three. 1 The *Magnitude*, or extent of a Countrey. 2 The *Bounds*. 3 The *Qualitie*. The Magnitude comprehends the Length and Breadth of any Region.

Some man might imagine that I make a needless repetition of these proprieties: forasmuch as many of them seeme to haue beeene spoken of before in our *Sphericall* part. But I answere that I there handled no other matters, but such as concerned the whole globous body of the Earth. But my intent here is to treat of such proprieties, as particularly designe out a speciall place. For it is not one thing to speake of the *Magnitude* of the whole Earth, according to all its dimensions; & to treat of the manner of measuring some particular Region, marked out in the Spheare. We haue defined the Magnitude of a Region to be either of *Length* or *Breadth*: because (as wee haue taught in our former chapter) it is a space contained in the surface of the Earth. Then can it not according to Geometricall grounds, exceed two Dimensions: These two Dimensions (as we haue said) are length and breadth, whereof every plaine figure, or superficies consists.

- 5 The Magnitude of a Region may be measured

sured two waies: either by the *Diameter*, or the *Circumference*. The *Diameter* is considered either in *Latitude* or *Longitude*: of the *Latitude*, whence ariseth the *Breadth* of a Country from *North* or *South*, note these Rules.

1. *If the place whose breadth is sought, bee distant from the Æquatour, and be wholly situat in the same Hemisphare, the lesser Latitude subtracted from the greater will giue the Diameter.*

To put this Rule in practise, it behoues the Topographer, who would finde out the greatnessse of any Region, to obserue two *Latitudes*: to wit, to measure the *Latitude* in the most *Northerne* point, where it is greatest: as also in the *Southerne* point, where it is least of all. This latter subducted from the former, will giue the *Diameter* or *breadth* from *North* to *South*: which may easily, according to the Rules in the former booke, be reduced into *Miles*, or other such measures. For an example we need goe no farther then our Iland of *Great Britaine*: The *Southernmost* part of which lying about *Star-point* in *Devon*, hath in *Latitude* about 50 degrees: The *Northermost* point situate neare the mouth of the riuier *Ardurnus* in the *farthermost* part of *Scotland*, hath in *Latitude* about 60 degrees (to omit minutes) The *lesser* of these *Latitudes* subtracted from the *greater*, the residue will be 10 degrees, which being imagined in the *Meridian*, which is a *greater circle*, are to bee multiplied by 60, and so conuerted into *Miles*, which will bee 600, the length of *Brittany* from *South* to *North*.

2. *If the place whose Magnitude we enquire, bee under the Æquatour, the Southerne Latitude added*

added to the Northerne wil shew the breadth
from the North to the South.

To illustrate this by an example, we will take the whole continent of *Africa*, whose Southerne Latitude about the Cape of *Good hope*, we shall finde to be neare thirty Degrees: the most Northerne Latitude about the straights of *Gibralter*, very neer the same rate: These two summes added together will amount to 60 Degrees, which multiplied by 60, the number of miles answerable to a degree in a great circle (because we suppose it here to be an Arch of the Meridian) we shall haue 3600 miles, the breadth of *Africa* from South to North.

4 The measure of the length of a Region betwixt East and West, admits of two cases: for either the Country is supposed to bee without the first Meridian, or vnder it: both which shall be taught in these Rules.

1 If the Region be situate without the first Meridian, the lesser Longitude subtracted from the greater, will shew the Diameter betwixt East and West.

For an example of which we will take *Cape de Barca*, lying ouer against *S. Thomas Iland* in *Africa*, vnder the *Æquator*, whose Longitude is about 30 Degrees, and *Melride* situate neere the *Æquator* ouer against *Sinus Barbaricus*, on the other side of *Africa*, which hath in Longitude 63 Degrees. The least Longitude, to wit 30, being subdueted from 63, there will remaine 33 Degrees; which being taken in a greater circle, which is the *Æquator*, or a Parallel very neare (which admits no sensible difference) we multiply by 60, and there will arise 1980 *Italian miles*, but if the Degrees bee taken in one of the lesser Parallelles, we must proceed according to the Table of miles answerable to Degrees of Latitude in the former booke.

Another

7 Another Case is when the place is situate vnder the first Meridian: The length & measure of such a Region is found out by this Rule.

1 Let the Westerne Longitude be subtracted out of the whole circle, and to the Residue added the Easterne Longitude, the summe will give the greatnesse and distance betwixt East and West.

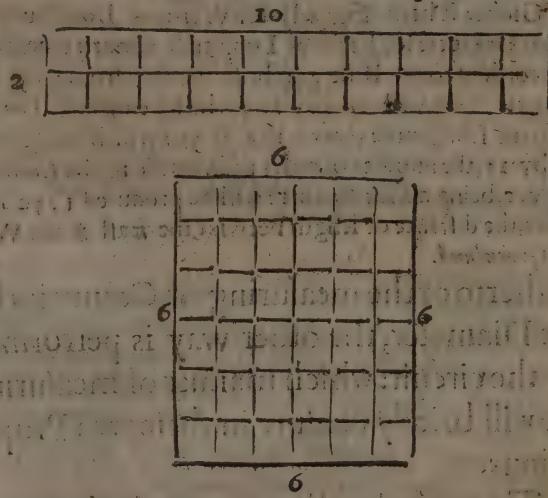
For an instance we will take *Greenland*, supposed in most of our Globes and Mappes, to be an Island which is set down directly vnder the first Meridian, passing by the *Azores* in *Kerius* his Globe: It hath assigned it for Westerne Longitude about 340 Degrees: for Easterne Longitude about 30 degrees. Then according to our Rule 340 be subtracted from 360, the whole circle, there will remaine 20, which being added to 30 the Easterne Longitude there will arise 50: which being multiplied by 25, the number of miles answerable to the Latitude of the place, being about 65, there will be produced 1250 Italian miles, the distance or length betwixt the East & the West part of *Greenland*.

8 Hitherto of the measuring of Countries by the Diameter; the other way is performed by the circuit: which manner of measuring we will briefly censure in these two Propositions.

1 The measuring of any Country by the Circuit of it, is very deceitfull and full of errors.

It hath beene a common custome amongst Navigatours to judge of the greatnesse of any Country, by sayling round a

bout it; which kinde of measuring is not alwaies to be rejected forasmuch as in new discouries sometimes no other way can be had. Neuerthelesse this manner of measuring must needs proue very vncertayne for diuerse reasons. First in regard of the motion of the ship, which by reason of diuerse and contrary winds, which must needs happen very frequently, cannot alwaies moue with the same swiftnesse. Secondly because the Sea it selfe (as we shall hereafter shew) hath in diuerse places diuerse speciall motions and currents, as from the East to West whence it must needs inforce an inæquality of motion in the ship. The third reason, which is greater then all the rest, is drawn from the various *Figuration of Countries*, whose greatnesse cannot be knowne by the circumference. Because (as Geometricians teach vs) two figures may haue one & the selfe same circuit about them, and yet the one shall extraordinarily exceed the other in greatnesse: as for example, let there be ima-



gined two *Parallelogrammes*; the one an exact square of six foot; the other a long square of 10 foot in Length, and two in Breadth. The one comprehends 36 square feet, the other 20, as

as will appear by multiplication of their sides, the one into the other; in which numbers there is a great inequality. Yet notwithstanding if we measure the circuit or circumference of each Figure, we shall finde them & quall, to wit, of 24 foot, as will appear by their figures here prefixed. For amongst those Figures called *Isoperimetral*, or of & quall Perimeter, that is alwaies to be esteemed the greatest, which is the more *Ordinate* figure: which is that, which commeth neerest to an & qualitie of *Sides* and *Angles*. But in *Inordinate* Figures (which nature for the most part are all Regions) infinite error may bee committed, if we measure them by circumnavigation: wherefore to measure a Country more exactly it behoueth vs not only to knowe the *Circumference*, but also the *Diameter*.

2 *Those Countries are more exactly measured which partake of a plaine surface.*

The reason of this *Propositiō* is easily shewed, because a *plaine Superficies* consists of right lines. But a right line (as Euclide witnesseth) is the shortest betwixt his owne bounds: whereas betweene two points infinite crooked lines may bee drawne: whence it must needs follow, that more certainty and exactnesse is to bee expected in the measure of a *Plaine Country* whose *Diameter* is a *Right line*; then from a *Crooked* and *hilly* *trey*, *Region*, where the *Corde* is *crooked* and *gibbous*. Whence some *Mathematicians* have demonstrated, that more men may stand on a *Sphērical* *Superficies*, as a *Hill* or *mountaine*, then on a *Plaine*, although both are found to be of the same *Diameter*. It may be here obiected, that the earth is euery where crooked and orbicular, & therefore no part thereof can be measured by a *Right line*: I answere that the Earth is indeed *Sphērical* (as we haue formerly proued) yet may some little part or portion thereof be counted as a *Plaine*; because such parts haue little or no proportion to the whole masse of the Earth. This convexity therefore being so little, may passe for a *plaine* without any sensible error. Hence wee may gather that the *Land* cannot so exactly be measured as the *Sea*. Forasmuch as the land for the most part is *vneuen*, *varied* with *hills*,

Dales, and other inequalities. But the Sea every where plaine and like it selfe, except the rising of the waues & surges, which in so great a distance will make no difference at all. Secondly, we may hence collect that of two Countries of the same bounds and figure, that must be the greatest whose soyle and superficies is most varied and crooked: because (as wee haue said) crooked lines betwixt the same points are longer then right, and therefore measure the greater Magnitude.

9. Thus much of the Magnitude. The Bound of a Country is a line compassing it round.

This definition is very evident, in that every Region is *Topographically* considered as a *Plaine* or *Superficies*, whose bound is a line compassing it round: for as a *Line* is bounded by a *Point*, so a *Superficies* by a *Line*, as we are taught in *Geometry*. Now we must consider that the bounds of Countries may bee taken two manner of waies: First *Geometrically*, for the meere line, which is imagined to goe round about it: Secondly, *Geographically*, for the visible markes and Characters, whereby the line is traced out vnto vs, such as are *Rivers*, *Cities*, *Hills*, *Castles*, and such like. These markes whereby a *Topographer* nozeth out vnto vs the bounds and limits of Countries, are of two sorts; either *Naturall* or *Artificiall*. The naturall are such as are deriuued from nature without mans appointment, such as are *Rivers*, *Creekes*, *Mountaines*, *Woods*, & such like other matters, which bound the extents of Countries. The *Artificiall* bounds are such as depend vpon some constitution or decree of a man, which so divide one Country from another: the partition being often made where no notable marke or bound is set by nature.

I. *Naturall bounds are more certaine then Artificiall.*

The reason is because naturall signes or markes which are set for bounds of Countries are alwaies the same, and (as it were) continued from the first creation: and cannot be changed without some great *Earthquake*, *Inundation*, or such like alteration.

in nature, which very seldom happeneth, and in very few places: whereas on the contrary part, such bounds and limits, as depend vpon mans appointment, may be altered and changed according to the wills and dispositions of men: as we daily see amongst vs, that ancient lands and inheritances are much questioned concerning their bounds and limits: as also great controuersie is made amongst Geographers concerning the bounding of Countries and Territories, anciently knowne and defined by old writers: For names and particular contracts betwixt men in a few ages, may easily slip out of memory; especially when the possessours themselves (as it often happens) striue to extinguish and raze out the memory of former ages, leauing behind them no marke or signe to tell the world their wronged neighbours right, or the limited fortunes of their owne possessions.

2. *Æquall bounds doe not alwaies containe equall Regions.*

This Proposition is plainly demonstrated before in this very Chapter: wherein wee haue proued of two figures supposed æquall in the circumference, that to be the greatest, which more neerely approacheth an *Ordinate* figure: which wee define to be that which commeth neerest to an æquality of Sides and Angles. So that two Regions, the one round, the other square, may haue an æquall compassie about, and yet the former will be a great deale greater, in respect of the space therein contained.

3. In the next place we are to consider the Quality. By the quality I vnderstand the naturall temper and disposition of a certaine place.

1. *Speciall places are endowed with speciall tempers and dispositions.*

That Almighty God, who created the whole world, hath no

granted the same gifts and endowments to all Countries, but hath diuided diuerse commodities to diuerse Regions, seemeth a matter out of all controuersie. For who finde not by expe-
rience one Country *hot*, another *cold*, a third *temperate*: one
fruitfull, another *barren*, a third *indifferent*, one *heathie*, another
symbolome. The like diversitie is also found in the Inha-
bitants themselves, according to that common prouerbe: *Va-
lentes Thebani, Acutiores Attici*: whence this diuersitie should
arise, it is a hard matter to vnsold; forasmuch as many causes
herein concurre, sometimes to helpe, sometimes to crosse one
the other: yet will I striue as neete as I can, to reduce them to
certaine Heads, by which a generall guesse may bee giuen to
the particulars. The first reason may bee drawne from the si-
tuation of the Earth, in respect of the heauen & Starres there-
in fixed. This may cause a diuersitie of disposition two waies;

1 By reason of the Sun, and his generall light & influxe: whence
in the Earth are ingendred the foure first qualities of Heate,
Cold, Drouth, and Moisture, whereon depends a great part of
the disposition, not only of the soyle, but also of mans body:
forasmuch as the one ordinarily borrowes his fruitfulness or
barrennesse of these first qualities: and the other hath his vitall
Organes (which are the ministers of the Soule) much affected
with them; insomuch as some Philosophers haue vndertaken
to define all the differences of mens wits and intellectuall fa-
culties out of the Temperament of the braine, according to
these foure accidents. And what Physician will not acknow-
ledge, all these Qualities and their mixture to challenge an ex-
traordinary preheminence in the disposition and constitution
of mans body, whose mixture is the first ground of health or
sicknesse. The second meanes whereby the Heauenis may cause
a diuersitie of Temper in diuerse places, is from the *Speciaall In-
fluences* of some particular Starres and constellations incident
to particular places: for it were blockish to imagine that so
many various Starres of diuerse colours & magnitudes should
be set in the Firmament to no other vse then to giue light to
the world, and distinguish the times: sith the ordinary Physitiā
can easilly discouer the Mooches influence by the increase of hu-
mours

mours in mans body: and the experiance of Astrologers will warrant much more by their obseruation; as assigning to each particular aspect of th: Heauens a particular and speciall influence and operation. Now it is evident that all aspects of the Heauens cannot point out and designe all places alike; forasmuch as the beames wherein it is, conveyed, are somewhere perpendicularly, other where obliquely darted; and that more or lesse according to the place: whence it commeth to passe that neither all places can injoy the same Temperament, nor the same measure and proportion. Yet wee say not that the heauenly bodies haue any power to impose a *Necessitie* vpon the *wills* and dispositions of men; but only an inclination: For the Starres worke not. Immediatly on the intellectuall part or minde of man, but Mediatly, so farre forth as it depends on the Temperament and materiall organes of the body. But of this we shallespecially speake hereafter. Where (God willing) shall be opened the maner of this celestiall operation. By this we may vnderstand how farre the Heauens haue power to cause a diuersitie in Places and Nations. The second reason may be the *Inbred Qualtie, Figure, and Site* of the Places themselues; For that there is another cause of diversitie besides the situation of places in respect of the Heauens, may easily be proved out of experiance; for we finde that places situate vnder the same Latitude, partake of a diuerse and opposite Temper & disposition, as the middle of Spaine about Toledo, which is very hot and the Southermost bound of *Virginia*, which is found to be Temperate betwixt both: All which notwithstanding are vnder the selfe same Latitude, or very neare, without any sensible degree of difference: also we sometimes finde places more Southward toward the *Æquatour* to partake more of cold, then such as are more Northerne, as the Toppes of the *Alps* being perpetually couered with Snow, are without question colder then *England*, although they lie neerer to the æquator. Likewise *Alvares* reporteth that he saw Ice vpon the water in the *Abyssines* Countrey in the month of Iuly, which notwithstanding is neere or vnder the Line. And *Martin Frobisher* relates, that he found the ayre about *Frieland* more cold & stormy,

stormy about 61 degrees the in other places neere 70 degrees. Wherefore we must needs ascribe some effect and operation to the soyle it selfe: first in respect of the *Superficies* which is diversly varied with *Woods*, *Riuers*, *Marshes*, *Rockes*, *Mountaines*, *Vallies*, *Plaines*: whence a double varietie ariseth: first of the fourre first *Qualitez*, which is caused by the *Sunne-beames* being diversly projected according to the conformity of the place: Secondly of *Meteors* and *Exhalations* drawne vp from the Earth into the Aire: both which concurring must needs cause a great varietie in mans disposition: according to that proverbe, *Athenis tenui cælum, Thebis crassum*: or that bitter taunt of the Poet on *Bæotians*, *Bæotum in crasso iurare aëre natum*. For ordinary experiance will often shew that a thinne & sharp ayre vsually produceth the best witts; as contrariwise grosse and thicke vapours drawne from muddie and marshy grounds thicken and stupifie the spirits, and produce men commonly of blockish and hoggish dispositions and natures, vnapt for learning, and vnsuit for ciuill conuersation. Secondly, there must needs be granted to speciall Countries, certaine *Specificall* qualities, which produce a certaine *Sympathie*, or *Antipathie* in respect of some things or others: whence it commeth to passe that some plants & hearbs, which of their owne accord spring out of the Earth in some Countries, are found to pine and wither in others; some Beasts and Serpents are in some places helldome knowne to breed or liue, wherewith notwithstanding other Regions swarme in abundance: as for example, *Ireland*, wherein no Serpent or venomous worme hath beene knowne to liue, whereby *Africa* and many other Countries finde no small molestation. Neither is this variety only shewne in the diuersity of the kindes, but also in the variation of things in the same kinde, whereof we might produce infinite examples. For who knowes not, which is a *Physition*, that many simples apt for medicine growing in our land, come farre shorte in yerue of those which are gathered in other countries. I need amongst many ordinary instances giue no other then in our *Rubarb* and *Tobacco*: whereof the former growing in our Countrie, except in case of extremitie, is of no vsse with our *Physitians*: the other

as much scorned of our ordinary Tobacconists: yet both generally derived from the true mother the *Indies*, in great use & request. But of this last Instances are most common, and yet for their ignorance of the true cause, most admirable. The causes of the former might in some sort be found out either in the Heauens, or in the Elementary nature of the Earth. But some speciall proprieties haue discouered themselues, which cannot be imagined to owe their cause to either, but to some third originall, which the Physicians in their Simples more properly term *virtus specifica*. If any man should demand why countries farther from the course of the Sunne should be found hotter, then some which are neare? Why the *Rhenish* wine Grape transported from *Germany* into *Spaine*, should yeeld vs the *Sherry Sacke*? Every ordinary Philosopher, which hath trauelled little beyond *Aristotles Materia Prima*, will be ready to hammer out a cause, as ascribing the former to the Heighth or Depression of the soile: the latter to the excesse of heat in *Spain* aboue that of *Germany*. But should we farther demand, 1 why *Ireland* with some other Regions indure no venomous thing. 2 Why Wheat in *S. Thomas Iland*, should shut vp all into the Blade, and never beare graine? 3 Why in the same Iland no fruit which hath any stome in it, will euer prosper? 4 Why our Mastiffes (a seruiceable kinde of creature against the molesta-
tion of Wolues, and such hurfull beastes) transported into *France*, should after a litter or two degenerate into Curses, & prove altogether vasseruiceable? 5 Why with vs in *England*, some places produce Sheep of great stature but course wooll; other places small Sheep, but of very fine wooll: which being naturally transplanted, will in a generation or two so degenerate the one into the others nature, that the greater sheep loose somewhat of their greatness, yet improue their fleeces; as the other increase their stature, but loose much in the finenesse of their wooll? 6 Why many places at the ridge of the moun-
taines *Andi* in *America* cannot bee passed ouer without extreame vomiting and griping euen vnto death. 7 Why a Ri-
ver in the *Indies* should haue such a nature to breed a great long worme in a mans leg, which oftentimes proves mortall

vnto the patient, with infinite the like examples sound in Geographers, concerning the nature and accidents of *Fountaines, Hearbs, Trees, Beasts, and Men* themselues (as wee shall shew hereafter) so much varied according to the disposition of the soyle, what wiser answer can an ingenious man expect then silence or admiration? for to make recourse to *Sympathies, Antipathies*, and such hidden qualities with the current of our philosophers, is no other then in such sort to confess our own ignorance, as if notwithstanding, wee desired to bee accounted learned: for beside the difference of the tearmes wherein euery Mountebanke may talke downe a iudicious Scholler; I see no aduantage betwixt a Clowne which saies he is ignorant of the cause of such an effect, or of a iuggling Scholler which assignes the cause to be a sympathie, antipathie, or some occult qualitie. I speake not this to countenance supine blockishnesse, or to cast a blocke in the way of curious industrie. The former disposition I haue alwaies hated, and the latter still wished in my selfe, and admired in others. Al which I can in this matter propose to a curious wit to be sought, must be reduced to one of these two heads: for either such admirable effects as wee haue mentioned, must arise from some *Formall* and *Specificall* vertue in the soile, or from some extraordinary Temperament made out of a rare combination of the Elements, and their secondary mixtures, as of *Hearbs, Stones, Mineralls, and vapours* arising from such, and affecting the Aire: of both which wee shall haue some occasion to treat in the particular Adjuncts of places; yet so, as I feare I shall neither giue my selfe content, or my Reader any sufficient satisfaction. But *In magnis voluisse sat est.*

11 Hitherto of the commo inbred Adjuncts of the Earth Topographically taken: Next we will speake somewhat of the *Magneticall* Affections of a place: These are in number two, viz: *Variation and Declination.*

We haue in our former Treatise of the *Magneticall* nature of the Earth handled diuerse other affections, growing from the Magneticall Temper and disposition of the terrestriall Globe: whence some man might here collect this repetition to bee altogether needless, or at the least imperfect, omitting many other of the Magneticall Affections. To this I answe, that it is one thing to speake of these Affections as they agree to the whole Spheare of the Earth: Another thing to consider them, as they are particular proprieties, and markes of particular places and Regions. In the former sort haue we besides the Variation and Declination handled many other affections of the Earth magnetically considered. We here only speake of these two, as they are speciall markes and proprieties of speciall places: which it behoues a *Topographer* to obserue as a matter worthie observation in the description of any place. The vse shall be commended vnto vs in these two Theorems.

I *The Magneticall Variation is of no vse for the first finding out of the Longitude; yet may it serue to good purpose for the Recognition of a place heretofore discouered.*

The reason of this we haue shewne in our former booke; because the variation seldom or neuer answeres proportionally to the Longitude, as some of the ancients on false grounds haue surmised: whence no true consequence can bee drawne from the variation of a place to the finding out of the Longitude; yet may it be of speciall vse for the new finding out of such places as haue formerly by others beeene first discovered, so the variation were first by them diligently and faithfully noted and obserued: first because few places in the Earth can exactly and precisely agree in the selfe same variation; but in some Degree or minute will be found to varie. Secondly, if any two places should be found to accord in the same Degree of *Variation*; yet comparing the variation with the degree of *Declination*, wee shall commonly finde a difference: forasmuch as places agreeing in variation, may notwithstanding varie in the Declination.

Thirdly, if two places should be equalized in both (as we cannot denie it to bee possible) yet the comparing of these two Magneticall motions with other affectiōns, as well in respect of the Earth it selfe as of the Heauens, will giue at least a probable distinction: of which cases it is not hard out of the obseruatiōns of our new writers and Nauigatours to giue particular instances. Concerning the first, we finde the variation of the compasse at *Cape Verde*, to be iust 7 Degrees; about the Ilands neare to *Cape Verde* to amount only to 4 Degrees; whence a Sea-man (if other helpe failed) may hereafter, as hee passeth, distinguish the one from the other, and if occasion serue, correct this error. In the like sort might a man (otherwise altogether ignorant of the place) out of former obseruatiōns, in the same Iland of *Cuba* distinguish betwixt *Cape Corientes* and *Cape S. Anthony*; In that the one hath only 3 degrees of variation, whereas the other hath 13: for an instance of the second case we will take the coast of *Brasil* 100 leagues distant from the shoare, and *Cape Corientes* beyond *Cape bona spēi*, which agree in the same variation: to wit, amounting to 7 Degrees 30 minutes: which notwithstanding are distinguisht by their severall variations: for howsoeuer the magneticall motion of variation being of late inuented, hath not so particularly beeene traced out in all or most places, yet must the declination of each place needs be different; forasmuch as the former hath 23 degrees of South Latitude, the other none at all, lying iust vnder the *Æquinoctiall*: since the Latitude (as wee haue formerly caught) is in some measure proportionall to the Declination. For the third, if any two places be found agreeing both in Variation and Declination, as may be probably guessed of *Cape Rossē* in *S. Johns* Iland, and the West ende of *S. John de Porto Rēgo*: the Latitude being all one as of 17 degrees 4 $\frac{1}{2}$ minutes: and the variation admitting perhaps insensible difference, to wit, of a little more then one degree: yet might this helpe conioined with former Trauellers report, or some small obseruation of heauenly bodies, or sounding the bottome of the Sea, settle our opinion and make a plaine distinction.

2. *The Declination of any place being knowne the Latitude may also be found out, although not without some error.*

The ground of this Assertion we haue formerly handled in the Treatise of the Magneticall Affectiones of the Earth; where we haue shewed that the Declination of the Magneticall needle is alwaies answerable in some proportion to the Latitude of the place: whence it must needs follow, that the declination anywhere being found out together with the proportion, the Latitude must needs be knowne. In this point I referre my Reader to D. Ridley's late Tr:atise of Magneticall bodies & Motions, wherein he by the helpe of M. Briggs, hath calculated a certaine briefe table for this purpose. But that this manner of Inuention of the Latitude of a place, must needs admit of some error, cannot well be denied; forasmuch as *Gilbert, Ridley, & others*, which haue written of this subiect, haue acknowledg'd this motion of Declination to be in many places irregular, and not answerable in due proportion to the Degrees of Latitude, which diuerse friends of mine, well experienced in magneticall experiments, haue to their great wonder confessed.

12. This much for the *Internall* Adiuncts.

The *Externall*, I call such as are not imprest into the Earth, but externally adjacent or adioyning vnto it. Here ought we to consider the *Aire* adioyning to any place with his Qualities and Proprieties.

13. The Ayrie properties of a place consist in such matters, wherewith the Ayre according to diuerse places is diuersly affected and disposed.

In the Ayre we ought to note at wofold temper and qualitie,

the one *Inbred* and *Essentiall*: the other *Externall* and *Accidental*. The former, whether it be heat ioined with moisture, as Aristotle affirmes, or cold ioined with moisture, as some others, I leaue it to the Naturall Philosopher to dispute. The latter being that to which our purpose is chiefly engaged, and that no farther then may appertaine to the Topicall description of a speciall Country. These accidents being so various and many, we are inforced to reduce them to a few generall heads which we will couch in this our Theoreme.

I *The disposition of the Ayre adjacent to a place depends chiefly on the Temperament of the Soyle.*

Those things wherewith the Aëriall Region is affected, are of two sorts; to wit, either the *Temperament* consisting in the mixture of the 4 first *Qualities*; or else the bodies themselves, as *Meteors* drawne vp into the Aire, whereof these accidental dispositions arise. That both these chiefly depend from the *Temperament* of the Earthly Soile of a certaine place, many reasons will demonstrate: first that *Meteors*, whatsoeuer they are take their originall from the Earth, is plaine. 1 Out of the name, which signifies things lifted vp, to shew that a *Meteor* is lifted and drawne out of the Earth. 2 Out of the materiall composition, which can no where else take this composition: For either we should derive it from the *Heauens*, or from the *Ayre* it selfe, or from the *Fire*: From the *Heauens* it cannot take originall; because it is corruptible, and therefore of no heauenly substance according to *Peripatetick Philosophie*. Not from it selfe, because the aire being supposed a simple and vncompounded body, cannot admit of such mixture. Not from the *Fire*; first because all *Meteors* partake not of fierie nature. Secondly, because fire cannot well subsist, but of some matter whereon it may worke, and conserue it selfe, which can be no other then that which is of a glutinous substance: which we nowhere finde but in the earthly *Globe*, consisting of *Earth* and *Water*; out of whose store-houses, the matter of all such pendulots

dulous substances in the aire is derived. These Meteors may be deuied from the Earth into the Ayre two manner of waies. First, *Directly* and *immediatly*, by an immediate ascent or rising of exhalations from some one particular place into the Ayrie space right ouer it. Secondly, *Obliquely*, to wit, when Vapours, or other such exhalations are by some violence or other carried from one place into another: as winde, which being ingendred in one place, continually bloweth into another. Againe, the former may happen two waies: for either this rising of Exhalations out of the Earth, is *Ordinary*, or *Extraordinary*: Ordinary I call that whereby the thinne parts of the water or Earth are continually spread and diffused through the whole Region of the Ayre: for we cannot imagine otherwise then that at all times and places, the Terrestriall Globe composed of Earth and Water; continually sends and euaporates out some thinne or rarified parts, wherewith the earth is affected. Whither this Rarefaction or Euaporation of the water be the true substance of the Aire it selfe (as some haue probably conjectured) or else some other body different from it, I will not here dispute. This much will necessarily follow, that it proceeds originally from the Earth right vnder it. This vapour being ingendred from the water or moister parts of the Earth, is much varied and temper'd according to the place from which it ariseth: For the matter of the Earth being various & diverse in disposition, as well in regard of various veines of minerall substances, whereof it consists, as of the first and second qualities thei e of arising, must of necessitie cause the Aire about each Region to be of the same qualitie. Whence a probable reason may be shewne; why of two places, although both like in respect of the Heauens, and other circumstances, one should be hot, the other cold; one healthie, another contagious; the one of a sharpe and thinne aire, the other of a foggy & dull temper: For no question but the minerall matter where of the soile of the Earth consists, being not every where Solid and hard, but every where intermedled with a vaporous & fluidie substance, must needs challenge a great interest in the Temperament of the Ayre, as that which is the first mother, if not of

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the Aire it selfe, yet at least of the accidentall dispositions there of. The Extraordinary evaporationes I call such as arise out of the Earth by some extraordinary concourse of the Sunne, with some other Starres. These are many times subiect to sense, which happen not at all times and places: such as are clowdes, windes, and such like, which arise not naturally by their owne accord by a perpetuall emanation, but are by some greater strength of the Sunne or Starres rarifying the parts of the earth or water drawne vp to the Aire about it. Now for the Meteors *Indirectly* and obliquely belonging to any place, amongst many other instances, we may bring the winde which bloweth from one Region to another; which according to ordinarie experience partaketh of a twofold qualitie; the one deriuued from the place whence it is ingendred; the other from the Region through which it passeth. Which may appeare by our foure Cardinall windes, as they are with vs in *England, Belgia, and higher Germany*. For first our Easterne winde is found to bee driest of all others, whereof no other cause can be giuen, then that it comes ouer a great Continent of land lying towards the East, out of which many drie & earthly exhalations are drawn: so the Westerne winde is obserued to be very moist, because it passeth ouer the hugie *Atlantick Ocean*, which must needs cast forth many watrie and moist vapours, which beget raine and showres: from the moisture of which Westerne windes some haue sought out an answere to that Probleme: why hunting hounds should not sent, nor hunt so well, the windes being in the West, as at other times? For, say they, it is caused by the moisture of it, either in making hinderance to their legges in running, or at least to their smell, being very thicke and foggy. In this Westerne wind we may also perceave much cold, which is caused by the qualitie of those watrie vapours, through which it passeth, which being drawne from the water, are naturally cold. In our South wind we shall finde both heat and moisture: whereof the former ariseth from the Sunne, which in those Southerne Regions neare the *Æquator* is most prædominant; The latter from the naturall disposition of the place: because before it approacheth our coasts, it passes ouer the

Mediterranean

Mediterranean Sea, out of which the Sunne begets abundance of wavy vapours, which mix themselves with the windes. Finally the North-winde is obserued to be cold and drie. It must of necessitie be cold: because it is carried ouer diuerse cold and snowie places, most remote from the heat of the Sunne. It is drie; because it passeth ouer many Ilands and dry places, sending out store of dry exhalations: as also because the Sunne being very remote from those Regions, fewer exhalations are drawne vp, which might infest it by impressions of their watrie qualitie. These instances may serue to proue our assertion: That Meteors, wherewith the Aire is vsually charged, and by consequence, their qualities imprest into the Aire; are depending from the Earth, out of which they are drawne, either *Directely* from the same Region which they affect; or *Obliquely*, from some other Region remote from it. Howsoeuer, wee obserue, that the disposition of the Ayre depends from the Soile, we cannot altogether exclude the Heauens, as shall be taught hereafter in place conuenient.

C H A P. III.

*Of the Adjuncts of a place in respect of
the Heavens.*

1. **W**e haue in the former Chapter spoken of the Adjuncts of a place in respect of it *Itself*. Wee are now to proceed to such Accidents as agree to a place, in respect of the Heauens.

2. The Adjuncts of the Earth in respect of the Heauens are of two sorts; either *Generall* or *Speciaall.*

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Generall, I call such as are abstracted from any speciall qualitie, or condition of the Earth, or any place in the Earth. These accidents concerne either the *Situation* of the Inhabitants, or the *Division* of the places: both which we haue handled in our Sphericall part of *Geographic*: The *Speciall* are such as concerne the nature of the place in respect of the Heauens, not *Also*, *Lately*, but *Respecting* some speciall qualities or properties depending on such situation; which more properly belongs to this part: For the vnfolding of which, before wee descend to particularities, we will premisse this one generall Theoreme.

I. Places according to their diverse situation in regard of the Heavens, are diversly affected in quality and constitution.

This Proposition needs no prooфе, as being grounded on ordinary experience: for who findeſ not betwixt the North and the South, a manifest difference of heat and cold, moisture and drouth, with other qualities thereon depending, as well in the temper of the soyle it ſelue, as the naturall diſpoſition of the inhabitants. Only three points will here require an expositiōn: First, by what *Meaneſ* and instruments the Heauens may bee ſaid to worke on the Earth. Secondly, how farre this operatiōn of the Heauens on the Earth may extend, and what limits it may ſuffer. Thirdly, how theſe operations are diſtinguished one from the other. Concerning the first, we are taught by our ordinary Philosophers, that the Heauens worke on inferiour bodies by three instruments, to wit, *Light*, *Motion*, and *Influenceſ*. By *Light*, as by an instrumentall agent, it ingendreth heat in the Aire and Earth; not that the light being in a ſort an Immateriall qualitie, can immediatly of it ſelue produce heat, being materiall and elementary; But by attrition and rarefaction, whereby the parts of the aire being made thiner, approach nearer to the nature of fire, and ſo conceaue heat. This is againe performed two waies: either by a ſimple or compouned beame. The ſimple Ray is weaker: The compounded inſerring a doubling of the Ray by *Refleſtion*, is stronger and of

more

more validitie in the operation: and by consequence so much the more copious in the production of heat, by how much more the reflection is greater: if wee merely consider it in regard of the Heauens, without any consideration of the quality of the Earth. By motion the heauens may exercise their operation on the Earth two waies. First, by attenuating and rarefying the vpper part of the Aire next adioining, turning it into *Fire* (as some Philosophers would haue it) whence the inferiour parts of the aire communicating in this affection must needs partake some degrees of heat; But this I hold to bee a conceit grounded only vpon *Aristotles* authority; who supposed the heauens to be a solid compact body: which will not so soone be granted of many of our moderne Mathematicians. Secondly, the heauenly bodies may be said to worke on inferiour things by motion; in that by motion they are diuersly disposed and ordered to diuerse Aspects and configurations of the Starres and Planets, whereby they may produce diuerse effects: so that in this seale the heauens are imagined as a disponent cause, which doth not so much produce the effects themselves as vary the operation. Hereon is grounded all Astrologie, as that which out of diuerse aspects and combinations of the Planets and Signes foresheweth diuerse euents. The third Instrument, by which the Heauens are said to worke, is the heauenly influence; which is a hidden and secret qualitie not subiect to sense, but only known and found out by the effects. This third agent being by some questioned, would hardly bee beleued; but that a necessity in nature constraines it. For many effects are found in inferiour bodies, caused by the heauens, which can no way be ascribed to the *Light* or *Motion*. As for example, the production of *Metalls* in the bowels of the earth, the *Ebbing* and *Flowing* of the Sea; whereof neither the one or the other can challenge any great interest in the *Light*: Forasmuch as the former is farre remote from the Sunne-beames: the other ceaseth not to moue in his channell, when the Sunne and Moone are both vnder the Earth. Besides, who can give a reason of the excesse of heat in the *Caniicular* or *Dog-daisies*, if he exclude this influence? For if wee consider the *Light* of the

Sunne, we shall finde it greater at the time of the *Solstice*; the reflection being greater approaching nearer to right Angles. If we consider the Earth, we shall finde no reason at all, why the heat shoulde be more predominant at this time then an other. Then must we of necessity ascribe it to a speciall *Influence* of the *Dog-starre* being in coniunction with the Sunne. Many other Instances might be here produced, but I hold it needless, being a matter consented to amongst most Philosophers. The second point concernes the *Extent* and limitation of this operation in inferiour bodies: for vnfolding of which point, wee must knowe that this operation may haue respect either to the Elements of *Earth* and *Aire*, or else to the Inhabitants residing on the Earth. For the operation of the Heauens vpon the Elementary masse, experience it selfe will warrant; yet with this limitation, that this operation is measured and squared according to the matter whereinto it is receaued: as for example, we shall finde the *Moone* more operative & predominant in moist Bodies, then in others, partaking lesse of this quality. Likewise the heat caused by the Sunne more feruent where it meets with a subiect which is more capable. Whence it comes to passe that one Country is found hotter then another, although subiect to the same Latitude in respect of the Heauens: for howsoever the action of the Heauens be alwaies the same and vniiforme in respect of the Heauen it selfe, yet must the same bee measured and limited according to the subiect into which it is imprest. For the Inhabitants, wee are to distinguisla in them a twofold nature: the one *Materiall* as partaking of the Elements, whereof euery mixt body is compounded. The other spirituall, as that of the Soule. The former wee cannot exempt from the operation of the Heauens: forasmuch as euery Physician can tell how much the humours and parts of our body are stirred by celestiall influence, especially by the *Moone*, according to whose changes our boies daily undergoe an alteration. For the humane soule, how farre it is gouerned by the stars is a matter of great consequence; yet may wee in some sorte cleare the doubt by this one diffi.ction. The Heauens may be said to haue an operation vpon the soule two manner of waies.

First, *Immediately* by it selfe. Secondly, *Mediately* by the humours and corporeall organes, whereof the Soul's operation depends. The first we absolutely deny; for the soule being an immateriall substance, cannot be wrought vpon by a material agent, as Philosophers affirme: for the second, it may be granted without any absurditie: For the operation of the soule depends merely on materiall and corporeall organes. The Elementary matter, whereof these organes consist, are subiect to the operation of the Heauens, as any other Elementary matter. So that we may affirme the Heauens in some sort to govern mens mindes and dispositions, so farre forth as they depend vpon the bodily instruments. But here we must note by the way, that it is one thing to inferre a *Necessity*; another thing to give an *Inclination*. The former we cannot absolutely aver; forasmuch as mans will, which is the commandresse of his actions, is absolutely free not subiect to any naturall necessity, or externall coaction. Yet can we not deny a certaine inclination; forasmuch as the soule of a man is too much indulgent vnto the body; by whose motion it is rather persuaded then commanded. The third point we haue in hand, is to shew how many waies the Heauens by their operation can affect & dispose a place on the Earth. Here we must note that the operation of the Heauens in the Earth is twofold; either ordinary or extraordinary. The ordinary is againe twofold; either *variable* or *Invariable*. The variable I call that which is varied according to the season, as when the Sunne by his increase or decrease of heat, produceth *Summer* or *Winter*, *Spring*, or *Autumne*: which operation depends from the motion of the Sunne in his *Eclipticks* line, wherein he comes sometimes neerer vnto vs, sometimes goeth farther from our verticall point. The Invariable, I call that, whereby the same places are supposed to injoy the same temperament of heat or cold without any sensible difference in respect of the Heauens; putting aside other causes and circumstances: for howsoeuer every Region is subiect to these fourre changes, to wit, *Summer*, *Winter*, *Spring*, and *Autumne*: yet may the same place injoy the same temperament of *Summer* & *Winter* one yeare as it doth another without any great

alteration: and this depends from the situation of any place nearer or farther of in respect of the *Æquinoctiall* circle. The Extraordinary operation of the Heauens depends from some extraordinary combination or concurse of Planets particularly affecting some speciall place; whence the cause may be probably shewed why some place shoulde some yeares prooue extraordinary fruitfull, other times degenerate againe to barrennesse: or why it should sometimes be molested with too much drouth, and other times with too much moisture. To let passe the other considerations as more appertaining to an *Astrologer* then a *Geographer*, we will here only fasten on the *Invariablie* operation of the Heauens on earthly places; and search how farre forth the places of the Earth are varied in their Temper and Quality, according to their diuerte situations, and respect to the *Æquinoctiall* circle; taking only notice of the Diurnall and ordinary motion of the Sunne in his course. Herein shall we finde no small varietie, not only in the temper of the Ayre, but also in the disposition and complection of the Inhabitants: both which we shall more specially declare: the former in this Chapter; the other in due place: wherein we shall haue occasion to treat of the materiall constitution and manners of diuerte Nations.

- 2 In respect of the Heavens, a place may bee diuided two waies: First, into the *North* & *South*. Secondly, into the *East* and *West*.
- 3 Any place is said to be *Northerne* which lyeth betwixt the *Æquatour* and the *Arctick* *Pole*. *Southerne*, betwixt the *Æquatour* and the *Antarcticke-Pole*.

The whole Globe of the Earth (as we haue formerly taught) is divided by the *Æquatour* into two Hemispheres; whereof the one is called *Northerne*, lying towards the *Northerne* or *Arctick* *Pole*; the other towards the other *Pole* is called the *Southern*

Southerne. But here to cleere all doubt , we must vnderstand that a place may be said to bee Northerne or Southerne two manner of waies: either *Absolutely* or *Respectively*: Absolutely Northerne and Southerne places are tearmed, when they are situated in the *Northerne* or *Southerne* Hemispheres , as wee haue taught in this Definition ; But such as are Respectively Northerne, may be vnderstood of such Regions, wherof the one is situate nearer the Pole, the other nearer the *Æquatour*. In the first place here we are to consider a place as it is absolutely taken to be either North or South: Concerning which wee will particularly note these two Theorems.

I *Northerne and Southerne places alike
situate, generally inioy a like disposition.*

We haue formerly granted to every Region or Country a speciall quality or temper : although lying or situate vnder the same Latitude. But here excluding all concurrent causes which may vary the temper of the Soile, wee consider the disposition of a place so farre forth as it depends on the *Heavenly Influence* or operation. In which sense we cannot deny to a place of like site, a like nature, for as Philosophers vse to speake, *Simile qua simile semper aptum natum est simile producere*; Like causes alwaies produce like effects: so the Heauens in like distance, being disposed alike as well in regard of *Light* as *Influence*, cannot but affect those parts of the Earth in the selfe same manner. For the Instruments by which the heauens worke on inferiour bodies (as we haue shewed) are *Light* and *Influence*. For both the *Light* and *Influence*, it is certaine that in places of æquall Latitude and respect to the *Æquatour*, it is cast æqually: both the one and the other being imagined to be carried in direct lines or beames, which with the *Horizon* makes like Angles. Now that the validity or weaknes of the operatiue Raies is to be iudged according to the *Right* or *Oblique* incidency, making right or oblique Angles, no Mathematician will gainsay. But here we must note by the way , that we only consider the Heauen according to his generall *Influence* or operation depending chiefly on the *Sunne*: not of the speciall operation

of speciall Starres, for it may be some particular constellations in the Northerne Hemisphære may bee indowed with some speciall influence, which is not found in the Southerne; or the South in this kinde goe beyond the North. But this kinde of Influence is rare and hard to finde, by reason of the various mixture of diverse constellations in their operation in the same subiect: and howsoeuer it were we l' knowne, yet it is not so notable to take place before this common Rule, which wee shall finde to take place, if not exactly, yet commonly through out the whole Terrestriall Sphære. Thus Bodin shewes a great likenesse betwixt the higher *Germany*, and the kingdome of the *Pantagones*, in the South part of *America*, out of the great *Sta-
ture* of the inhabitants, which must needs proceed out of the nature of the places, which are found to be situate very neare vnder the same Parallel. The like correspondency haue we noted betwixt *Guinea* in *Africke* and that part (as it is thought) of the *South Continent*, which they haue for this cause termed *Nova Guinea*: many more Parallelis in this kinde might bee found out; but these may suffice in so evident a matter.

2 *The Northerne Hemisphære is the Masculine, the Southerne the Fœminine part of the Earth.*

It hath beene a vusual kinde of speech amongst men to tearme such things as are stronger, worthier, or greater, *Masculine*: on the contrary side such things *Fœminine* as are found deficit and wanting in these perfections: by which kinde of Metaphor taken from the Sexes in liuing creatures they haue ascribed to the Northerne Hemisphære a Masculine Temper in respect of the Southerne, which comes farre short of it: for howsoeuer no cause can bee shewed in regard of the Heauens (as is taught in our former Propositions) except by some speciall constellations of the South, which is full of vncertainty, & as soon denied as affirmed; yet comes it to passe by some hidde propertie of the places themselves, or at least some cœsuall Accident or other, that these two Hemisphære suffer a great and notable

notable disparity. For against the large and fertill Territoryes of the Northerne Hemisphære containing in it wholy *Europe* and *Asia*, with the greatest part of *America* and *Africa*, we shall finde (besides some few scattered llands) only three continents to oppose, to wit, a small part of *Africke*, the greatest part of *America Peruana*, containing in it *Peru*, *Brasile*, & the Region of the *Pantagones*, and the South continent called *Terra Australis Incognita*, and by some others, the *South-Indies*. For the former lying neere the *Cape of good hope*, if we will credit the relations of our owne Merchants, we shall finde the aire by reason of heat, very distemperate, situat betwixt the *Æquator* and the Tropike of *Capricorn*: The land very barren, the Inhabitants of a brutifh disposition, wanting (as it were) all sense of science or religion: bearing heauy as yet the curse of *Noah*, the first father of that *African Nation*. For *America Peruana* we shall finde it perhaps more happie in respect of the Soyle, although little better in respect of the Inhabitants. Yet for the plentie of Gold mines, whereof they can chiefly vaunt, we shall finde it farre surmounted by the *East Indies*, or at least paralleled by *America Mexicana*, lying on this side the *Æquinoctiall circle*. For other commodities, as *Cattle*, *Fruits*, *Herbage*, *Spices*, *Gummos*, and other medicinable roots, and mineralls, lesse question can be made, as being farre inferiour to *Europe*, *Asia*, *Mexicana* and other Regions included within our Northerne partition. Of the third and greatest, which is the South-continent, no coniecture can be well grounded, being in a manner all vndiscouered, except some small quillers on the borders of it: by which, if we may iudge of all the rest, we shall almost give the same iudgement, as of the other. The want of discouery in this age of ours, wherein Navigation hath beene perfected and cherished, is no small argument to proue it inferiour in commodities to other places: Neither had the slacknesse of the *Spaniard* giuen that occasion of complaint to *Ferdinand de Qair*, the late discoueret of some of these parts, had not the *Spanish King* thought such an expedition either altogether fruitleſſe, or to little purpose. For who knowes not the *Spaniard* to be a Nation as couetous of riches

as ambitions to pursue forraigne Soueraigntie: as such who will more willingly expose the liues of their own subiects, then loose the least title ouer other Countries. This may bee a probable argument, that this Continent hath not as yet so well smiled on the ambition of this proud Nation, as some other conquests. For *Politicall* and *Martiall* affaires, how farre shor it comes of our Northerne Hemisphare, I shall speake in due place, where I shall handle the naturall disposition of diuers Inhabitants according to their situation. To finde out the true causes of this diuersitie, is very difficult: To seeke a reason in some particular constellation, & Influences in the Heauens, or some speciall disposition of the soyle, is too generall to give satisfaction, and too vncertaine to inforce credulity. Yet putting these aside, I can only guesse at two reasons, which are accidentall, yet strengthned with good probability. The first & greatest is that bitter curse cast on *Cham* and his posterity by his father *Noah*, which no doubt was seconded by Gods displeasure taking place in his habitation. That all these Nations sprung from *Cham*, I dare not confidently auouch: Yet for the most part, it is probable they were of this Race. For the *Africans* it is out of question, as warranted by the holy Scriptures: and it is not vnlkely that many of those Southerne people fetcht their first originall from them. The second cause may be drawne from the *Industrie* and labour of the Inhabitants in tillage and manuring of the ground, wherein the Southerne Inhabitant hath beeene more deficient. For it is certaine out of the holy Scripture that *Noahs Arke*, wherein was the Seminary of mankinde, and almost all other liuing creatures, rested in the Northerne part of the world: whence both man and beasts beganne to be propagated toward the South, no farther then necessity enforced: the Regions inhabited growing daily more and more populous, and (as it were) groaning to be deliuered of some of her children. Hence may be inferred two consequencies. First, that the Northerne Hemisphare was inhabited sooner, and is now therefore more populous then the Southerne. Secondly, that the chiefeſt and principall men, which were best ſeated, rather chose to keepe their ancient habitation, ſending ſuch

such abroad, who could either bee best spared, or had the smallest possessions at home. Yet notwithstanding it cannot be imagined but they retained with them a sufficient company and more then went away. Out of which it must needs bee granted, that the Northerne halse of the Earth being best inhabited, should be best manured and cultured; from whence the ground must in time proue more fruitfull and commodious for habitation: for as a fruitfull Country for want of due manuring and tillage doth degenerate and wax barren, so diuerse barren and sterill Countries have by the industrie of the Inhabitants beeene brought to fertilitie, and made capable of many good commodities necessary for mans life. If I were curious to drawe arguments from the nature of the Heauens; I could alledge the *Greatnesse* and *Magnitude* of Starres of the greater magnitude in our Northerne Hemisphere, wherein the Southerne is deficient, as also the longer sojourning of the Sun in our Northerne Hemisphere: but these as *uncertaine causes* I passe ouer. Other reasons may perchance bee found out by those who are inquisitiue into the secrets of nature, to whom I leaue the more exact search of these matters.

4 Either Hemisphere consisting of 90 Degrees may be diuided into three parts, each of them containing 30 Degrees.

5 Of these parts 30 we allot for Heat, 30 for Cold, and 30 for Temperature: vwhereof the former lyeth tovwards the \textcircumflex Equatour, the second tovwards the Pole; the third be-
tween both.

The ancient Cosmographers (as wee haue shewed in our former Treatise) diuided the whole Globe of the Earth into fife *Zones*, which they supposed had also proportionally diuided the Temper and disposition of the Earth. In such sort that according to the Degrees of Latitude the Heat and Cold

shou'd increase or diminish. Which rule of theirs had been ver-
ry certaine, were there no other causes concurrent in the dis-
position of the Earth and Ayre, but only the Heauens. But si-
thence that many other concurrent causes, as we haue shewed,
mixe themselues with these cœlestiall operations, and the ex-
periment of Navigatours haue found out a disproportion in
the qualitie, in respect of the Distance, some later writers haue
sought out a new partition more consonant to naturall ex-
perience. The whole Latitude of the Hemisphere consisting of
90 Degrees from the Æquator to the Pole, they haue diuided
into three parts, allowing 30 Degrees toward the Æquator
to Heat; 30 Degrees towards the Pole to Cold; and the other
30 Degrees lying betwixt both to Temperature. These 30
Degrees for Imagination sake they haue subdiuided againe,
each of them into two parts containing 15 Degrees a peeces
more particularly to designe out the special disposition of each
Region, lying either Northward or Southward from the Æ-
quator, which is the bound betwixt both Hemispheres. In
the first section of 30 Degrees lying Northward from the Æ-
quator, we comprehend in *Africke, Numidia, Nigritarum Re-
gio, Lybia, Cuinia, Nubia, Egypt, Ethiopia superior. In Asia;
Arabia, India, Insula Philippina. In America, Nona Hispania,
Hispaniola, Cuba, with other parts of America Mexicana.* In
the other extreame section from 60 Degrees of Latitude to the
Pole, we comprehend in *Europe, Groenland, Island, Friesland,
Norway, Stetland for the most part, Nova Zembla. In Asia;
a great part of Scythia Orientalis. In America, Anien, Quivira
with diuerse other parts of the North of America Mexicana.*
In the middle betwixt both, betwixt 30 and 60 Degrees
of Latitude we comprehend in *Africa, Barbarie; in Europe, all
the kingdomes except those North Prouinces before named,
and almost all Asia, except some places toward the South, as
Arabia, India, and the Philippina Insula, formerly placed in the
first Section; In like manner may we diuide the Southerne He-
misphare into three Sections: In the first, from the Æquator
30 Degrees we place in *Africk, Congo, Monomotapa, Madagas-
car; In the Southerne Tract, Bech, & Nova Guinia, with ma-**

ny Islands therevnto adioyning, as many of the *Philippina Insula*, with *Insula Solomonis*. In *America*, *Peru*, *Tisuado*, *Brasilia*, with the most part of that Regio which they call *America Pernana*. In the other extreame Section from 60 Degrees to the Antartick Pole, is couched the most part of that great land scarce yet discouered, called *Terra Australis Incognita*. In the middle Region betwixt both, from 30 to 60 Degrees, shall we finde placed in *America*, the Region of the *Pantagones*, in the Southerne Continent, *Malitur*, *Lava minor*, with many others. In discouering the qualities of these severall Sections, or partitions of the earth, our chiefeſt discourse must be addreſſed to the Northerne Hemisphere, as that is more discouered and knowne amongst old and new writers; by which according to the former Proposition one may parallell the other, concerning which we will inferre these Propositions.

I. In the first Section of the Hemisphere the first 15 Degrees from the Equatour are found ſomewhat Temperate; the other 15 about the Tropicks exceeding Hot.

That the Region lying vnder the Equatour is Temperately hot, contrary to the opinion almost of all the Ancients, hath beeſe in part proued heretofore, as well by reason, as experiment; for that all places by how much the nearer they approach the Equatour, by ſo much more ſhould be hotter (as ſome imagine) diuerſe instances will contradict. It is reported by *Alvarez* that the *Abyſſine Embaffadour* arriuing at *Lisbone* in *Portugall*, was there almoſt choaked with extreame heat. Also *Purquer* the Germane, relates that hee hath ſelt the weaſther more hot about *Dantzicke*, and the *Baltiske Sea*, then at *Tholouſe* in a feruent Summer. The cauſes which wee haue before touched, are chiefly two. The firſt is, that the Sun is higher in this orbe in reſpect of thoſe vnder the Equatour, and mo-veſt more ſwiftly from them, ſpending on them only twelve hours, whence ſo great an imprefſion of heat cannot bee made as in other places: for heat being a materiall quality, muſt ne-

cessarily require some Latitude of time to be imprest into the ayre, or any other subiect. From the Diminution of heat in the Region must the ayre needs receave into it selfe the contrary qualitie of cold. An argument of cold may bee drawne from the testimony of *Alvarez*; who affirmes the waters there in the month of June, to be frozen ouer with Ice, the Southwinde blowing. The second cause is by iudicious writers, ascribed to the subtilty and rarity of the Aire vnder the *Æquinoctiall line*, which cannot receave into it selfe so many degrees of heat as the thick and grosse aire of diuers places distant. For the North Region, wherein *Europe*, and a great part of *Asias* placed, is for the most part full of waters, which bursting out of secret & ynknoynge concavities, doe produce infinite *Fenus*, *Bogges*, *Lakes*, and *Marshes*, which in the Summer season cause infinite vapours to abound, which being intermixed with heat, scorch and heat more seruently then the purer ayre of *Africke*, being for the most part free from the mixture and concourse of such slimie vapours. That the aire being thickned should yeeld a greater seruour, every man out of ordinary experience can frame to himselfe an argument: For wee see Fire and Heat being incorporated (as it were) in the Steele or Iron, to burne and heat more then in Aire or Wood. The like reason some would drawe from the keepers of Stoues or Hot-houses, which doe besprinkle the ground with water, that the vapour being contracted and the aire thickned, they may the longer and better maintaine heat and spare Fuell. Another cause (which we haue formerly touched) may be drawne from the *Set* and *Anniver-* *windes* which blowe most part of the yeare one way. *Iosephus Acosta* obserues that betwixt the Tropicks the winde is for the most part Easterly, beyond Westerly: and a Dutch discouerer hath related that in *Guinea* they haue a certaine winde which comes from the land till noone: and then very violent from the Sea, insomuch as the Inhabitants are wont to traffick in the morning being not able to indure it: which if it bee true we cannot imagine this Region to be so hot as men suppose. For here the heat in the night is asswaged, by the absence or remotenesse of the Sunne: Likewise the excesse of heat incident

to noonetide, is much qualified (or as it should seeme by this relation) altogether vanquished by the cold winde derived from the Sea. Another reason no lesse probâble may be deriu'd from the excessive height of the land and great mountaines, observed to be neere or vnder the line, whose tops are always couer'd with Snow, may give a sufficient testimony of cold. For instance, wee need goe no farther then the ridge of the mountaines *Andi* in *America*, where they obserued the Ayre to bee so thinne and cold, that it inforsed them to scowre and vomit, which came neare it. The like whereof is related of another called *Punas*, where the extremitie of cold cutteth off their hands. From which experience we may finde some places neere the Line to be more infested with cold then heat. The last and greatest reason may bee taken from the continuall moisture wherewith the regions situate betwixt the Tropicks frequent- ly abound. This moisture is deriu'd from two causes; 1 from the melting of the Snow on the tops of the mountaines by the Sunne, which running from thence continually into the vallies, keepe them almost alwaies watrish, especially in the midst of Summer when the Sunne is neerest. 2 From the extreame heat of the Sunne, which being very neare, and many times verticall, raiseth vp continually moist vapours in great quantitie. These vapours in so short a time as 12 houres, being not con- sumed, but meeting with the cold from the middle Region of the aire, are therewith conuerted into drops, which fall downe againe in great showres: insomuch as some trauellers of good credit haue told me, that all the while they sayled betwixt the Tropicks, they seldom saw the Sunne, by reason of raine and clowdy vapours. Whence wee note with *Josephus Acosta*, by way of consecrety, that the presence of the Sunne betwixt the Tropicks produceth moisture, but contrariwise without the Tropicks, it is the cause of drouth: whence the inhabâts injoy as it were a Winter, when the Sun is to them verticall, because of the distemperature by Windes, Raines, and Stormes, and great Inundations, wherevnto commonly all great riuers be- twixt the Tropicks are most subiect. Also they seeme to haue a Summer, when the Sunne is in or neare the Tropicks because

becaūse being somewhat remoued, he cannot be so powerfull in drawing such store of vapours and exhalations which he can dispell and consume. Thus wee see the moity of this first Section lying 15 degrees from the *Æquatour*, howsoeuer subiect to a greater reflecion of the Sunne-beamies, yet through the concurrence of other causes to be found indifferently Temperate, and the other 15 degrees about the Tropicks, howsoeuer subiect to a lesser Reflecion to be excessive hot: which later cause, besides all which hath beene said before, shall bee further confirmed hereafter by the complection of the native Inhabitants, which we shall finde to be *Choller-adust*, the true symptome of an externall heat. But if any man shall answere that this accident is incident as well to the Regions situate vnder the *Æquatour*, as to that vnder the Tropicks; I will produce another reason drawne from the colour of their countenances; which vnder the *Æquatour* is not seene so blacke and swartie as elsewhere. For toward the Tropicke, is placed the Land of *Blackmores*, or *Nigritarum Regio*, where the people are all coleblacke: which might perhaps happen also to those that dwell vnder the other Tropicke; but that other causes interpose themselues, which hinder the excesse of heat, which is taken to be the chiefe cause of this blacknes; Here some would oppose the opinion of *Herodotus*, which referred the cause of this blacknesse in the Negroes, to the *Seed* which hee would haue to be blacke: others would haue this blacknesse as a curse inflicted vpon *Chams* posterity: but these opinions carry very little shew of probability. For first, if this former opinion were admitted, it would of necessitie follow (ifaith *Bodin*) that *Ethiopians* in *Seythia* should alwaies be borne blacke, and *Seythians* in *Ethiopia* should be alwaies white. Forasmuch as all nations from the beginning of the world haue beeene confused and mixt by the distraction of Colonies: but experience teacheth vs, that men transplanted into another Soyle, will in manner of trees and Plants by little and little degenerate & change their first disposition. As if a *Blackmore* marry and beget children here with vs in *England*, experience will plainly declare the children to be more inclining to whitenesse then the fathers.

and

and the grand children more then them. Secondly, if the second opinion of *Chams* curse deserved any credit; I see no reason why all his posterity (such as by most writers consent, are generally the people of *Africke*) shalould not bee subiect to the same execration, as well as one little parcell of it. Moreover it is reported by *Plinie*, and confirmed by *Appian*, that in those places are many blacke Lions, which wee can ascribe to no other cause then the excesse of heat, and not to any quality of the Seed, or any curse inflicted on the place: Moreover it is reported by *Ferdinando de Quir* in his late discouery of the South Continent, that he there also found some black people; yet can we not imagine this Land, though stretching very farre in quantity toward the *Æquinoctiall*, to come so farre or much farther then the Tropick of *Capricorne*. These arguments make it the more probable that the Regions situate vnder the Tropicks, generally exceed more in heat, then those placed in the middle of the Earth vnder the Line.

2 In the other extreme Section from 60 Degrees towards the Pole, the first 15 Degrees towards the *Æquatour* are more moderately cold; the other towards the Pole most immoderately cold, and vnapt for convenient Habitation.

That this Section of 30 Degrees comprehended betwixt the 60 Degree and the Pole, is in a sort habitable, is confirmed by the testimony of many Navigatours, especially the *English* and *Hollanders*; who haue aduentured very farre Northward, and haue there found the Earth, though not so fruitfull, yet furnished with some commodities, and peopled with Inhabitants. The first 15 Degrees towards the *Æquatour* admit of no great exception, containing in their extent *Finmarke*, *Bodia* in *Scandia*, *Nova Zembla*, *Anian*, *Greenland*, with many other places indifferently discouered: where they haue indeed found the aire very cold in regard of this of ours: Yet not so Immoderate,

but that it can at all times agree with the naturall temper of the natvie Inhabitants, and at least at some times of the yeare admit a passage for forraigne Nations. But the other Region stretching Northward from 75 Degrees to the Pole it selfe, howsoever it may be probably thought habitable, yet affords it no conuenient meanes and sustenance for mans life, in respect of other places; neither can the people of this climate inioy any good compleetion or Temperament of the foure qualities; forasmuch as the cold with them is so predominant, that it choaketh, and almost extinguisheth the naturall heat; whence *Hippocrates* saith that they are dried vp, which is a cause of their swarty colour, and dwarfish stature; which assertion of his can obtain no credit, but of such Northren people as liue neare the Pole; Neverthelesse wee shall not finde these poore Northerne nations, so destitute altogether of vitall aides, but that their wants are in some sort recompensed by the benefit of nature. The chiefeſt comforts in this kinde, which we inioy, and they ſeeme to want, are *Heat* and *Light*. The defect of heat is ſomewhat mollified; 1 By the Sun ſtaying ſo long aboue their Horizon as 6 months, and by conſequence impreſſing into the Aire a greater Degree of heat. 2 By the naturall cuſtome of the Inhabitants, neuer acquainted with any other temperature; both which reaſons we haue formerly alledged. 3 By the induſtry of the Inhabitants, being taught by neceſſity to preſerue themſelues during the Wiſter time in *Caves*, *Stones*, and ſuch like places heated with continuall fires: the defect of which prouidence, was thought to be the ruine of S^r *Hugh Willoughby*, intending a ſearch of the North eaſt paſſage on the North of *Lapland* and *Russia*. To recompence the defect of Light, Nature hath prouided two waies: 1 In that the Sunne in his Parallell comming neerer and neerer to the Horizon, giues them a long time of glimmering light both before his riſing & after his ſetting: which may ſerue them inſtead of day. 2 For that the Sunne and Starres by reaſon of a refraction, in a vaporous and foggie Horizon, appeares to them ſometime before he is truly riſen: wth cauſed the *Hollanders* in *Nova Zembla*, to wonder why they ſhould ſee the Sunne diuerſe daies before ac-

cording

According to their account he was to rise aboue their Horizon according to Astronomicall grounds: which probleme had staggered all the Mathematicians of the world, had not the Perspicue science stopt in to giue an answere.

3 In the middle Section betwixt 30 and 60 Degrees of Latitude, the first 15 are Temperately Hot, the other 15 more inclined to Cold.

The middle Region partakes a mixture of both extremes, to-wit, of the cold Region towards the Pole, and the hot towards the Aequator: whence it must needs follow, that the more any parts of this Tra&t approach the hot Regiō vnder the Tropicke and Aequator, the more it must partake of Heat: yet this heat being mittigated by some cold by reason of the fire of the Sun, it must of necessity be Temperate and very apt for humare habitatio. Also this mixture of the cold quality being more extended and increased on the other moity towards the Pole through the vicinity of the cold Region, must loose much of the former heat, which shall hereafter be more confirmed out of the naturall constitution & complection of the Inhabitants; bearing the true markes of externall cold and internall Heat, whereof the one is strengthened by the other: For the externall cold, if it be not ouer predominant, and too much for the internall Heat, will by an *Antiperistasis* keepe in & condensate this heat, making it more seruent and vigorous.

6 The East & West Hemispheres are bounded and divided by the Meridian passing by the *Canaries* and the *Molucco Islands*.

7 The East Hemisphere reacheth from the *Canaries* the *Moluccoes* on this side; as the other on the opposite part of the Spheare.

We may here note a great difference betwixt this diuision and the former. For the North and South Hemispharees being diuided by the *Æquator*, are parted (as it were) by Nature it selfe, and the Sunnes motion; But the diuision of the Globe into East and West, we can ascribe to no other cause, then mans Institution: yet are the Easterne and the Westerne found to differ many waies, the discouery of which may giue great light to obseruation.

1. *The Easterne Hemisphare wherein we liue
is every way happier and worthier then the
other Westward:*

How far short the Westerne Hemisphere comes of this of ours, many circumstances may declare. For first, if we compare the Quantitie of Land, we shall finde a great disparicie. For the Westerne Hemisphere containes in it besides the Southerne Continent (wherein ours also claimes a moity) only *America*, with the Ilands thereto adioyning: whereas the other within this large circuit containes all the other parts of the Earth knowne vnto the Ancients, as *Europe*, *Asia*, and *Africke*, with many Ilands to them annexed. Moreouer it is probably conjectured by some, that *America* is vsually on our Mapps and Globes, especially the more ancient, painted and delineated out greater then indeed it is: which hath been ascribed to the fraudulent deceit of the Portugalls heretofore; who to the end they might reduce the *Molucco* Ilands to the *East Indies*, then their owne possession; sought as well in their Mapps as relations to curtailt *Asia*, and indarge *America* in such sort, as the *Molucco* Ilands might seeme to fall within the 180 Degrees Eastward, wherein they fed themselues with vndeclared substance, and the *Caspians* with painted shadowes. But to let passe the quantity as a matter of lesse moment and lesse questioned; a great disparicie will be found in the *Qualitie* and *Dispositiones*. For what one commodity almost was never found in this Continent, which is not only parallellled, but surmounted by this our Hemisphere? If we compare the Mines of Gold & Siluer wherein consists the wealth and riches of both places; our *East Indies*

Indies will easily challenge the superiority. If *Trees, Plants, Herbage, & Graines*, let our Physicians & Apothecaries iudge, who owe most of these medicinable drugges to *India*: Let our Merchants answere, which owe their Spices to *Arabia*, their Wines to *Spaine, Italy, the Mediterranean, Gracian, & Indian Islands*; their Silkes, Linen, Cloathing, and their furniture almost wholly to *Europe*. If we compare the multitude and various kindes of Beasts bred and nourished in either place, no question but *Europe, Asia, and Africa* can shew farre greater Heards of *Sheepe, Cattle, and such like*, with farre greater variety of kindes, then euer were found in this new found Continent. If all these fayled, yet the well tempered disposition of the *Europeans and Asians* in respect of this barbarous and vnnurture place, disdaines all comparison: where we shall obserue on the one side a people long since reduced to ciuility, instructed as well in liberall sciences, as handy-crafts, armed with martiall discipline, order'd by Lawes and ciuill government, bound with a conscience and sense of Religion; on the other side a multitude of miserable and wretched nations, as farre distant from vs in ciuility, as place; wanting not only government, Arts, Religion, and such helps, but also the desire, being senselesse of their owne misery.

2. *The difference of East and West cannot work a diversitie in two places by any diversity of the Heauens.*

East and West places compared together, are either of *equall or vnæquall Latitude*. For places of *vnæquall Latitude* no question can bee made, but they receave a greater variety of Temper from the Heauens; as we haue formerly proued: but this disparity growes not out of the diuersity of *East & West*, but the distance of *North and South*. But that places alike situate in Latitude, cannot vary by any diuersity of the heauens is plaine; forasmuch as all things to them rise & set alike, without any diuersitie: wherefore, if any such diuersity bee at any place found, we ought not to seeke the cause thereof in the hea-

vens, but rather in the condition of the Earth it selfe, which no question suffereth in diverse places of the same Latitude a great variety.

8 Either Hemisphære may againe Respective-
tively be subdividid into the *West* or *East*.
The *West* in this our Hemisphære I call
that which is neerer the *Canary Ilands*; the
East that which lieth towards the *Molucco
Ilands*; to which points there are others
correspondent in the other Hemisphære.

1 *Places situate towards the East in the same
Latitude, are hotter then those which are
placed towards the West.*

For the explanation of this Theoreme, we are to examine two
matters; First, what probability may induce vs to beleue the
East to bee hotter temper then the West. Secondly, what
should be the cause of this diuersitie in both places, being sup-
posed æqually affected, in respect of the Heavens: for confir-
mation of the former, many reasons haue beeene alleged of old
and late writers. It is agreed on (saith Bodin) with a joint con-
sent of the *Hebreues, Greeks, and Latines*, that the *East* is bet-
ter tempered then the *West*: which haue labours to con-
firme; First, out of many speeches of *Ezekiell, Esay, & the
other Prophets*, where the *East* seemes to challenge a dignitie
& prerogatiue aboue the *West*; which betokeneth (as he ima-
gines) a blessing of the one aboue the other. But I dare not
venter on this Interpretation without a farther warrant. Se-
condly, we may here produce the testimony of *Pliny* in his se-
venth booke, where he affirms that by ordinary observation,
it is found that the pestilence commonly is carried from the
East into the *West*, which Bodin testifies himselfe to haue foun-
dy experience in *Gallia Narbonensis*, and many other historie

seeme to iustifie. *Amianus* a Greeke Author, obserues that *Selencia* being taken, and a certaine porch of the Temple being opened, wherein were shut certaine secret mystries of the *Chaldeans*; that a suddaine contagion arose of incurable diseases, which in the time of *Marcus* and *Verus* from the farthermost ends of *Persia*, spread it selfe as farre as the *Rhene* and *France*, and filled all the way with heapes of carkasses. If at any time the contagion be obserued to be carried another way, an vniuersall pestilence is feared: as according to the histories there happened not long after from *Aethiopia* towards the North, which infested the greatest part of the world. A third prooфе may be drawne from the testimony of *Aristotle*, *Hippocrates*, *Gallen*, *Ctesias*, and other graue Authors, who affirme that all things are bred better and fairer in *Asia* then in *Europe*; which must needs arguē a better temperature: To back which Testimonies, we need goe no farther then moderne obseruation. Every Geographer will tell you how farre infertilitie *Natolia* in *Asia* surmounts *Spaine*; and *China*, vnder the same Latitude exceeds both: who knowes not how farre *Fox* and *Morocco* on the Westerne Verge of *Africa*, stand inferiour to *Egypt*, a most fruitfull and happy Region? And how farre shorē both these come of *India*, situate in the same Climate. An argument of greater heat in the Easterne places may be the multitude of Gold and Siluer mines, Spices, & other such like commodities, wherein *Asia* much excells *Europe*: whereas such mettals and commodities as require not so great a measure of heat in their concoctiō, are rather found in *Europe* then in *Asia*: whence there seemes to arise a certaine correspondency of the East with the South, and the West with the North. The greatest reason of all is taken from the Temper and naturall disposition of the Inhabitants, forasmuch as the *European* resembling the Northerne men, shewes all the Symptomes of inward heat strengthned with exterrnall cold. The *Asiaticke* followes the disposition of the Southern man, whose inward heat is exhausted by exterrnall scorching of the Sunne-beames, & herfore partakes more of Choller-adust or *melancholy*. But this point we shall more fully prosecute in due place. To shew a cause of this

variety is very difficult. Those which in wit and learning haue farre exceeded my poore scantling, haue herein rather confesed their owne ignorance, then aduentured their iudgement. It were enough to satisfie an ingenuous minde, to beleue that Almighty God was pleased in the first creation of the world to endow the Easterne part of the Earth with a better temper of the Soyle, from whence all the rest derive their original: which seemes not improbable, in that he made *Asia* the first resting place of man after the Creation, the second Seminary of mankind after the Deluge, the only place of our *Saviour's Incarnation*. In this matter I beleue no lesse, and can speake no more, except I should vrge the beating of the great *Atlanticke Ocean* vpon our Westerne shoares; which may in some sort qualifie the excesse of heat incident to the Easterne tract, which may produce some degrees of Temperature. But here also we shall perhaps meet with crosse instances, which will stirre vp more doubt then satisfaction.

*C H A P. IV.**Of the manner of Expression and Description
of Regions.*

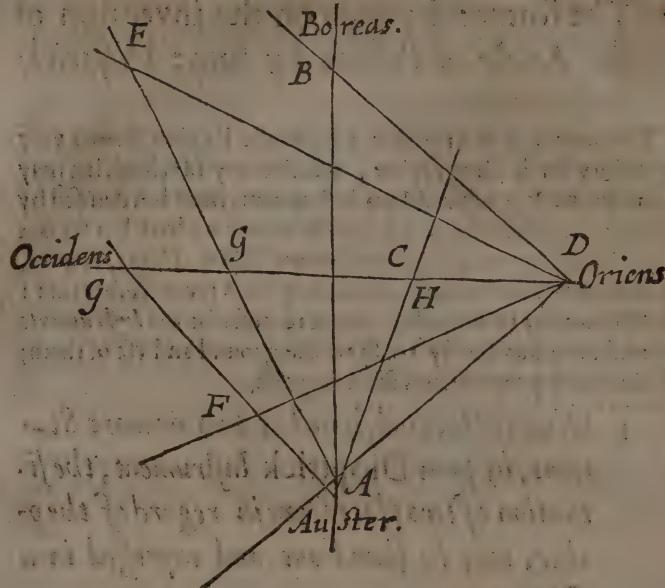
HAving treated of the generall Adjuncts of places, wee are next to handle the manner of describing a Region, which propoeth vnto vs two points, 1 the finding out the *Position* of two places, one in regard of the other. 2 The *Translation* of such places so found out into the *Globe* or *Charte*. 2 The

2 The former depends on the invention of
the Angle of Position by some Dioptricke
Instrument.

This maner of descriptiō of a particular Region, seemes very necessary for a Geographer, which every Mechanician may soon learne & practice. Many instruments haue bin devised by curious Artificers for this purpose: whose vse hath bin set out largely by later writers, as by *Gemma Frisius, Diggs, Hopton, and others*; to whom my reader may haue recourse, because I hold it not my taske in this subiect to describe the *Instruments* themselues; but briefly to shew the ground and vse of them; which these propositions shall expresse.

I Diuers places obserued at two or more Sta-
tions, by some Dioptrick Instrument, the si-
tuatiō of two places, one in regard of the o-
ther, may be found out and expressed in a
Plaine.

This may sensibly be shewed in the Figure following: to
expresse which the more plainly; we will set downe these
Rules: 1 Let there be drawne in some Chart or plaine plat-
forme, a right line, which we must accompt to be our Meridi-
an; because it shall afterward serue for that purpose. This
right line shalbe A B, whose two ends A and B shalbe taken
for the North and South. 2 You must choose out some high
place, as a *Towre* or *Mountaine*, from whence you may be-
held such cities, townes, castles, and other such notable places
whereof you desire to know the situation and bearing of the
one to the other: This High place is called the *First Station*;
where you must place the plaine before prepared in such sort,
as it may Astronomically and truly agree with the true Meri-
dian of the place (whose invention we haue taught in the first
Booke) and so respect the foure Cardinal coasts, to wit, *East*,
West, *North*, and *South*: Vpon this place seated in such a man-
ner



per of situation fasten your *Dioptrick Instrument*, that it may be turned about the point A on every side at pleasure, in such sort, as the sight may be directed to every one of the adjacent places. First then remouing it from A, direct your sight to F, and draw the line A F of infinite length: likewise your Instrument being directed to G, draw the line A G infinitely, which by this meanes will also hit the place E: Let B also be imagined a certaine place, as a City, or Castle, situate in the very Meridian it selfe, which we find already drawne to our hands. In like sort ought we to proceede with the other places C and D, and as many as we please.

This performed, you must remoue your selfe with your *Instrument* and *Plaine* to some one of these places thus fore-marked out; as for example vnto D, which is called the *second station*, and there as in the former, ascending vp some high place, the *Plaine* being first fittid and placed *Astronomically*, take

the

the Distance A D of any length whatsoeuer; for to the greatness of this Distance , shall all the rest bee proportionall. Hence so place your *Dioptrick* Instrument at the place D, that it may be turned round , and directed to all those places formerly obserued. In this sort levelling your sight to the place or castle F, draw the line D F: so directing your sight to the rest, you may draw the lines DCG,DE,DB,&c: Now by the points of Interse&ctions of these lines, as in F,G,E,C,B,&c: are to bee described and delineated out the said notable landmarks, as *Cities, Townes, Castles, Promontories*, and such like. Betwixt these places if any man desire to know the distance in miles, he may know it by finding out any one of these Distances; for one being knowne , the rest will also bee exactly knowne: as for example: we will imagine the Distance A D to containe 10 miles: wherefore let the line A D be diuided into 10 æquall parts: then with your compasse examine how many such parts are contained in the Distance A F, for so many miles will be likewise in it contained : as for example according to this supposition we shall find it 5 parts: wherefore the castle or city F wilbe 5 miles distant from the city A. He that desires more particularly to acquaint himselfe with the vse and diverse manners of descriptions of Regions , derived from this one ground; Let him haue recourse to diuerse Authors who haue particularly laboured in this subject; amogst which our two *Englishmen*, *Digges*, and *Hopton*, deserue not the least praise: whereof the latter, out of these principles hath framed a curious Instrument, which he call's his *Topographical Glasse* , whose vse he hath perspicuously and exactly taught in diuerse pleasant conclusions, too large for the scope of my methode to insert.

2. At one Station by opticall obseruation, the situation of one place in respect of the other, may be found out.

This may be shewed out of an opticall experiment, both pleasant & admirable: The ground is expressed in this propo-

sition: The light traieled by a narrow hole into a darke place, will represent in any Table or white paper within, what soever is without directly opposed unto it: For demonstration of which proposition, we must take as granted of the perspective Authors, That the visuall Image or species will passe by a right line through any little hole, & wilbe terminated in any point of the Medium: Now that it should more perspicuously be seen in a darke place, then in the light. The cause is assigned to be, because the light of the Sun is taken away, or much diminished, which otherwise would hide and shadow the species of the thing which is presented to the sight; as we see by experience the greater light of the Sun to obscure the Starres: which nevertheless from the darke bottome of a deepe Well or Mine, will shew themselfes at mid-day. Neuerthelesse we must obserue by the way, that this representation of any thing to the sight by this Image impressed in this sort in a wall or paper, will shew it selfe so, as the parts will be seene inversed, or (as we may say) turned on the contrary side: as the *higher*, *lower*; the *lower*, *higher*; the *right-side*, to the *left*; and the *left*, to the *right*: which we may declare by an ocular demonstratiō in this

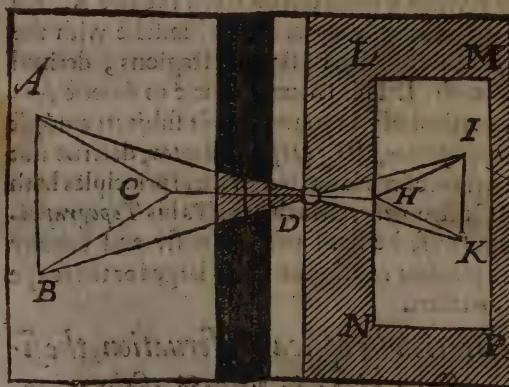


figure heere inserted: Let vs imagine a Triangular platforme of land, whereof we desire to know the situation, to be A B C: from the extreme Angles of this Triangle,

we will suppose certaine Rayes to be drawne through the hole D into a darke place, wherein shall be opposed to the hole D, a white Table or paper, which shal be N M: Here wil-

a Ray

1 Ray from the point designing out the Angle at A, be carried through the hole, that it will point out in the Table K. (because all such beames according to the *Opticks* are right lines.) Likewise the Angle B will in the Table designe out the Point I: also C will fall into the point H: Let K H, I K, H I, be ioyned together by right lines, there will appeare the Triangle I K H: wherein the top of the Triangle A will be seene in the lowest place K: Likewise the Angles of the Basis B and C, will appear in the points of the highest place H I: and the right side A C, will shew it selfe in the left H K: as the left side will be the right in I H: wherefore the side of the whole Triangle A B C will shew it selfe in the Table N M, although inversely placed according to the sides and Angles: and of a various greatness in respect of the distance of the Table from the hole. This invention hath great vse in *Astronomy*, in observing *Eclipses*, the beginning, end, & continuance, without any hurt at all to the sight. No lesse vse may it challenge in *Topography* in describing of *Territoryes, Cities, Borrowes, Castles*, and such like, in their due symmetry and proportion: To practise which the better, Reusner would haue a little house built of light Timber, with a *Multangle Basis*: in every one of whose sides, a hole should be made, looking inwardly, at the *vertex*, or top, but outwardly at the *Basis*: through which the species or Image of all such things as are visible may haue free passage:

- 2 The manner of translation of a Region into the chart, depends from the knowledge of the *Longitude* and *Latitude*.
- 3 The parts to be described, whereof the chart consists, are either *Essentiall*, or *Accidental*: The *Essentiall*, are either the *Lines*, as are the *Meridians* and *Parallels*: or the *Places* to be delineated out by *Pictures*;

The delineation of both which, shall be taught in these rules.

1 To set downe the Meridians and Parallels in a particular chart.

To shew the practise hereof, we will take for instance the Region of *France*, an example familiar with our later *Topographers*, and therefore can better warrant the descriptions: *France* is supposed to haue in latitude 10. degrees, in longitude 16: This knowne, you must proceede in this manner: First through the middle of your table from head to foote, let there be drawne a perpendicular line expressing the Meridian of the world, which shall be marked with the letters E F: let this line be divided into 10. equall parts: then draw two Parallel lines, whereof the one must crosse the said line about the point E with right angles: and the other Parallel must crosse it againe beneath in the point F with like angles: let the vppermost Parallel be expressed by A B: The neathermost with C D: Then with your compasse take one of the 10 parts of the line E F, which is one degree, and set that downe apart by it selfe, dividing the same into 60 Minutes, as the short line G H, in the table heere inserted will shew on the right hand. Now you may learne by some Table or Mappe, that the farthest part of *France* toward the *North*, through which is drawne the Parallel A B is 52. degrees distant from the *Equatour*: And that the South Parallel C D, is distant 42 degrees: Also certaine Tables in our former booke will informe you, that to every degree of the Parallel 42. delineated by A B, doe answere 37 miles: and that to euerie degree of the Parallel C D, answere 45 miles: wherefore with your compasse take from the short line G H, 37 partes or Minutes, and with your compasse kept at the same largenesse, let the Parallel A B be divided into 16 æquall spaces correspondent to that widenesse(that is to say) on each side of the Meridian 8 parts: at which Meridian E F, you must beginne your measure towards either hand both right and left, marking

marking the end of euery such space with a certaine point: Moreover for the South *Parallel* C D, let 43 parts likewise be taken from the short line G H, and let that *Parallel* be diuided into 16 spaces, correspondent to that widenesse of the compasse, eight spaces being set downe on each side of the Meridian E F: So that we must beginne from the Meridian E F, and marke the end of every such space with a point. Then from those points wherewith each of those two *Parallels* A B, and C D is marked; Let there be drawne a right line from point to point, and those shall serue for *Meridians*, expressing as well the longitude of the whole Region, as of every particular place therein seated. In like sort as you haue diuided the Meridian E F, into 10 æquall parts, so againe into the like number of æquall parts must be diuided each of the two vttermost *Meridians*, on the lefthand and the right, marking with a point the end of every such space, and so from point to point let there be drawne right lines, cutting all the *Meridians*, and those shall serue for *Parallels*, and in the vttermost spaces, let there be written the numbers of *Longitude* and *Latitude*. The *Longitude*, is supposed to beginne at the vttermost *Meridian* at the lefthand, which in both *Parallels* is the farthest *Meridian* Westward. Now forasmuch as the most Westerly *Meridian* is fourteene degrees distant from the *Meridian* passing by the *Canary Islands*, from which as the first *Meridian*, the auncients began their accornts: you must set downe in the first place on the lefthand, as well over, as vnder in the first space 15, in the second 16, in the third, 17, & so orderly proceed through all the spaces, til you come to 30: For the difference betwixt 14 and 30, is 16: So you haue the whole *Longitude of France* expressed in your Table, which is 16 degrees: In the like sort to expresse the *Latitude* (having the degrees of *Latitude* marked out) you must beginne at each end of the South *Parallel* C D, and so proceed vpward in the two vttermost *Meridians*, writing downe in the first space at the foot of the Table 43 degrees, on the right hand and the left, in the second space 44, in the third 45, and so vpwards along to 52, so haue you expressed the whole *Latitude*

itude of France from North to South: for betwixt 42 and 52 are comprehended iust 10 degrees: These degrees may againe be divided at pleasure into le sler parts, as minutes, according to the largenesse of your chart.

2 To set downe Citties, Castles, Mountaines, Riuers, and such like speciall places in the chart.

The platforme of your chart being once drawne out, as wee haue formerly taught in the praecedent rule, you may verely easily set downe speciall places by observation of the Longitudes or Latitudes of such places, either by Instruments or Tables, and reducing them accordingly to your chart: which we suppose before, marked out according to severall degrees: As for example, if we would set downe in our chart the *Metropolis of France*, which is *Paris*: having recourse to my Table, I find it to haue in *Longitude* 23 degrees, in *Latitude* 48 degrees. Heere to find out the said *Longitude*, you must extend a threed from the 23 degrees of the *Parallel A B* to the like degree in the *Parallel C D*: then holding it fast, you must crosse that threed with another extended from the *Meridian A C*, to the *Meridian A D* in the points of 28 degrees: The point wherein these two threeds shall cut and crosse one the other, you may take from the true place of *Paris*, and marke it out in your chart: In like sort you may proceede with all other places. But if you were to describe a riuer in your chart, it will not be sufficient to take the *Longitude* and *Latitude* of the beginning or fountaine, but of the end, middle, turnings, and angles, Townes, or Cities, by which it passeth, Bridges and other occurrent circumstances: In like sort may you set downe *Woods*, *Forrests*, *Mountaines*, *Lakes*, and other places whatsoever.

4 Thus much for the *Essentiall* part of the particular Chart: The *Accidental* part wee call the *Scale of Miles*, which teacheth how

many

many miles are contained betwixt any two places in the Chart: wherein wee are to know two things, 1 The *Fabricke*; 2 The *Use*.

1 The *Fabricke* of the Scale depends from the certaine knowledge of the Distance of any two places in the Chart.

The practise is very easie, and taught in these three Rules: 1 You must search out the distance betwixt any two places whatsoeuer, which are contained in the Region, described in your Chart; which you may doe either experimentally by your owne knowledge, or some certaine relation of Trauallers. 2 Then must you draw three *Parallel* lines, containing two spaces, one larger, the other lesser, in some voide space of your Chart. 3 You must diuide the said Scale into so many Miles, as the said voide space will give you leaue, according to the knowne distance first found out: As for example, the distance betwixt *Paris* and *Roane* is knowne to be 30 *French legnes*, which containes 60 of our Miles, allowing for every such legue, 2 Miles. Wherefore your *Parallel* lines being first drawne (as you see in the following Chart), diuide your Scale into 30 parts accordingly, and in the larger space, place your Numbers, as 10. 20. 30. and so forth, so farre as your space will conveniently extend.

2 The Distance of any two places set downe in the Chart, being taken and applied to the scale, will shew how many miles it containes.

As for example, I would willingly know how many *Englishe* Miles are contained betwixt *Paris* and *Orleans* in my Chart of *France*: Heere I take with my compasse the distance betwixt the said Cities in the Chart, and applying that to the Scale, I find it to containe 50 miles: which is the true measure.

CHAP. IV. *we would*

Advantages of Hydrography.

Itherto haue we treated of the Generall Adjuncts, & Proprieties of places in the Terrestriall Sphære: wee are in the next place to handle the Distinction.

2. A place is generally distinguished into *Water* and *Land*: The Description of the former is termed *Hydrography*; The other for distinction we call *Pedography*.
3. Hydrography is a Description of the Water, with the Accidents therunto belonging.

The Water we consider not here merely *Physically*, as it is an Element, whereof mixt bodies are composed; but *Topographically*, as it beares a part in the Terrestriall Globe: yet are we not so curious to exclude such *Physicall* problemes & considerations as are most subiect to sense; which a *Topographer* cannot well neglect: being the *markes* and characters, designing out speciall places: To finde out the originall of the Water, we must first take as granted, that Almighty God (as we reade in the first of *Genesis*) in the beginning made a separation betwixt the waters *above* the Firmament, and the waters *under* the Firmament; whereof the former is termed in the Scriptures *ȲD̄T*, which is as much to say, as *expansum*, a thing stretched out, or extended. By these waters *above* the Firmament, whether we ought to understand the cloudeis v-

parts in the middle Region of the Aire: or the *pure* fluid and liquid body, whereof the Firmament consists; I leane it to learned diuines and critick expositours to dispute; although the propriety of the phrase (if t be well sendred) will seeme to fauour this opinion rather then the other: forasmuch as the *Aire* can no way be said to be aboue the Firmament, except the *Hebrew* terme miscarri in the Translation. For the solidity of the Celestiall Orbis, which *Aristotle* labours to confirm, is found long since to thwart the observations of *Astromeris*: although it may thus be retained as vsefull *suppositiones* to settle *Imagination*. But to let this passe, and come to the waters under the Firmament, vnderstood by the word ~~mar~~, which signifies almuch as a collection of waters: we shall finde them to haue taken their originall from the separation of the waters substance from the Dry land, caused by God in the first Creation, testifid by *Moses* in 1 Gen: which once granted (as no Christian can deny) easily rebates the edge of the opinion of some auncient Philosophers, who contented, out of the nature of *Drouth* and *Moisture*, to deriuie the beginning of this separation. The drynesse of the Earth (say they) working by little and little, diminisheth or at least resisteth the waters, so that they should not altogether ouerwhelme the Land: But this reason is altogether deficient in Nature: Because *Drouth* and *Moisture* are no such qualities to haue such an operation: and if any such there were betwixt *Drouth* and *Moisture*, the *Drouth* (as we see by experience) would rather draw moisture vnto it, then any way expell it, or drue it away: whence it is most evident, that it was effected by no other meanes then the immediate worke and prouidence of God, for the preservation of luing creatures: for before God laid; Let the waters be gathered into one place: the Water was said to couer the whole face of the Earth: but afterwards at God's appointment, the water went back, and shewed the dry land. But by what meanes God separated the one from the other, it is much controveried amongst *Divines* and *Philosophers*. Many were of opinion, that the Earth was suffered to stand intire without alteration, and that the waters

were elevated aboue it; so that if they were suffered to flow a broad, they might againe couer the face of the Earth, as in the beginning. But why the Waters should be thus restrained, is not agreed among them: for some thought, that this was done by the miraculous power of God, which restraines the flowing abroad of the Water, beyond his ordinary bounds; of which opinion is *S. Jerome*, who grounded his opinion (as it seemes) on the authority of the Scripture; especially in the 8 of the *Proverbs*, and the 103. *Psalme*; where God is said to haue set a bound vpon the seas, which they shoulde not passe: But this reason seemes not warrantable; That the great Creator of all things, should in the first institution of *Nature* impose a perpetuall violence vpon Nature. Moreover all miracles are temporary, and not perpetuall; for then were it ordinary, and so scarce a miracle: others vpon lesse ground, haue imagined that there are certaine *Northerne* starres in *Virgynas* and *Draco*, of so great vertue, that they can draw the Ocean from this habitable part of the earth toward the North, and so constraine the waters, that they can not overwhelm the earth: but this opinion is ridiculous, and deserves no solide refutation: being a mere conjecture, without ground or probability: others vpon the like reason, haue dreamt that there is more water then earth in the *Globe*; and that the water by his extraordinary masse occupying the center of the world, turnes the earth on one side, making it to swimme as a ship vpon the sea: But this assertion we haue refuted in our first Chapter of the first booke: All these Authors suppose, that the earth is vncouered toward the North-Pole, but overflowed with waters towards the South; which the experiance of *Nauigatours* at this day hath sufficiently disnubled: Others againe assyning out of a *Peripateticall* dreame that the water is, ten times greater then the earth, suppose the earth to be like a sponge to drinke up the water: to proove which assertion they produce an experiment, that the earth being digged any thing deepe in most places, there will appere water: whence they collect that the water is mixt

with

with the whole earth, and received into it's concavities? But howsoeuer we may graunt, that there are many and vast concavities in the Earth, capable of Waters; yet it is impossible, that the Water should be ten times as great as the Earth: for by this reason, although all the ¹Terrestrial ²Globe were Water, it could not be, but that a greater portion of Water then that in the Earth, should arise aboue the Earth: because, according to their own *Supposition*, 9 partes should be aboue the Earth: Neither can *Aristotles* words be well wrested to this interpretation: forasmuch as he understood this ten-fold proportion of the Water in the Earth by *partes*, which they replenished, measured by their *Circles* and *Diameters*: but of the proportion they bear one to the other in their transmutation: as that one measure of Earth turned into Water, should be as much as 10. All these opinions seeming so absurd, it seemeth more probable to imagine, that either the Waters are *condensated*, and *thickened*, which were in the beginning created thinnes: whence will follow, that they should occupy a lesse place; and by consequence, leauie the dry land in many places habitable: or, which is more probable; that God in the first *Creation* made certaine hollow concavities and channels in the Earth, which was before plaine and uniforme, into which the waters were received and bounded, inasmuch, that they could not flow abroad. This seemes enough to satisfie the search of such as are not too curios to search into his secrets, whose power and omnipotence transcends the capacity of the wisest: In this division of a place into *Water*, and *Land*, we will first treat of the *Sea*, and the accidents belonging thereto: Not that the water is worthier or greater then the Earth: The contrary whereof we haue proved heretofore: but because the consideration of it, is more simple, as that wherein fewer matters are to be handled then in the land. For *Rivers* and *Lakes*, although consisting of this watery element, we thought fit to handle apart: as accidents belonging to the land.

4. In the *sea* are considered two things. 1. The

Adiuncts; 2 The Diuision: The Accidents of the sea whereof we are to treat, are either
1. *Internall*, or *Externall*.

5. The *Internall*, are such as are *inbred* in the sea: Thele againe are either, *Absolute* or
Relatiue.

6. The *Absolute*, are such as agree to the sea, without any comparison with the lande, such are either, *Figure*, *Quality*, or *Motion*.

7. The *figure* is the conformity of the *externall* superficies of the Sea; whereof obserue this Theoreme,

1. Although the whole body of the water be sphaericall, yet it is probable that the parts of it, incline to a *Conicall* figure.

That the whole Water according to it's outward *Superficies*, is *sphaericall* and *round*, is sufficiently demonstrated before, in the first booke. But notwithstanding this roundnesse of the whole, the parts of it may (for ought I see) admit of a *Conicall* figure; forasmuch as this hath little or no proportion to the vast *Sphericall* of the Water, no more then little hilts, to the greatnessse of the Earth. For the prosecution of which point, I will first shew the reason of this my conjecture, grounded on experience; and afterwards out of the ground and demonstration of the principles of *Mathematicall Philosophie*, endeavour to make it more manifest. First therefore by a *conicall* line, we understand a crooked line which differs from a *Periphery* or *circle*, in as much as it keeps not alwaies an equal distance from the center: but is higher in the midft, then on either side: Now if the parts of the water standing stil, were

in their higher superficies exactly sphaericall; they should by the same grounds be *concentricall*, or haue the same center with the whole Earth: But that it hath not the same center, will appeare by little *dropps* of Water falling on the ground, which incline (as we see) to a round figure; yet were it more then ridiculous to say, that this round convexity of a dropp could be *concentricall* with the whole Earth: sith in so great a masse, it is hardly sensible. But heere our ordinary Philosophers are ready to answere, that this conformity of the water dropps in a round figure, is rather *Violent*, then *Naturall*: because the Water being by nature moist, is ready to fly, and avoid the touch or drouth, or any dry thing. And because the Water thus avoiding the drouth, cannot of necessity but some way touch it, it is imagined to conforme it selfe to that figure, wherein it may least of all touch: This is the round or *sphericall* figure; wherein any body contained, cannot touch a plaine, other wise then in one only point. But against this conjecture of moisture flying drouth, strong enough is the experiment of *Scatiger*, in his 105 exercitation: that *quick siluer* a moist substance, being cast either into Water or *Iron Oare*, will gather it selfe to a round body; notwithstanding it is manifest, that *quick siluer* naturally neither avoide the touch of Water or *Iron*, forasmuch as the one is very moist, the other of great affinity, (as our *Chimicks* teach) with *quick siluer*, the parent of all *Metalls*. Moreover it is manifest, that this conformity to roundnesse, is in dropps of raine falling to the Earth, through the *Aire*: yet will not our *Peripateticks* admit of any drouth in the *Aire*, which this moist element should seeke to avoid. Moreover if Water should conforme it selfe to roundnesse, by reason of the drouth of the body, wherein it falleth, then must it follow; that either the moisture of the Water shold expell the drouth of the Earth; or else that the drouth of the Earth shold worke on the moisture of the Water; But neither can be graunted with probability, first because moisture & drouth are not qualities of such activity to drive and remoue, one the other from one place to another, as it is here imagined: 2^{ly}; if the moist should worke on the dry,

dry, it shoud either touch it or not: If it touches not, it can-
not worke on it; because no *Physical* action can be performed
without touching; besides, it were ygry impossible, to imagine
that without this touch, one of these qualities shoud perceiue
or sent the other to avoid it. If it touch, it avoides not the
touch, but ioynes it selfe with the drouth: And indeed reason
and experience shewes, that drouth rather couets & drawes
vnto it selfe moisture, then expels it; wherefore *Scaliger* goes
about to forge a new cause of this experiance. Every thing
(saith he) in his nature is one, and the selfe same: But this vi-
nity in Homogeneall bodies, is best preserued in a *Globe* or
round figure: wherein is no inæquality, no parts higher or
lower, abounding or deficient. But heere might a man aske
why the greater parts of the Water are not likewise con-
formed vnto roundnesse, as well as the lesser droppe; He
would perhaps answere, that nature in them was not in such
distresse, to make vse of this speciall priviledge; I graunt it:
yet find I in this no satisfaction; forasmuch as he giues a fi-
nal cause, where I sought an efficient; for I would farther aske
by what action or motion this water should gather it selfe in-
to a circular figure, and from what forme it shoud arise: for
first, we haue shewed, that this motion cannot proceed from
the externall drouth, we must seeke the cause in the water it
selfe: heere we shall finde it, either the *particular* forme of the
water, or a certain *vniversall* forme, as some suppose. It cannot
be imagined, that it shoud proceed from the generall forme
of the *vniverse*: First, because as we haue elsewhere proued,
there is no such *Internall* forme of the world: Secondly, those
motions are commonly ascribed to an *vniversall* Nature or
forme, wherein any particular body (as it were) neglects his
owne Naiure, for the preseruation of the whole *Vniuerse*. But
here water containing it selfe in an orbe, and not flowing a-
broad towards the Center, rather seemes to forsake the Cen-
ter and *Vniuerse* to preserue it selfe. Whence we must ne-
cessarily conclude, that this roundnes in drops of water cast
on the sand, proceedes not from externall drouth, nor any *V-*
niversall forme, but from the *Specicall* and *essentiall* forme of

the water; and consequently, because it makes a circle *excentricall* with the Earth, it must be found rising higher in the midst: To which we will adde another experiment: Let there be cast on a large Table or planke, a little portion or drop of water: Here aske, whither this water on the midst of the Table æquilibrated, will continually flow abroad, or at length suffer a stay or stop? It cannot be continually spread abroad: first, because experience teacheth the contrary; for we see little drops cast on such a plaine, to confine themselves within certaine bounds: and least any should imagine (as before) that this happens by reason of the drouth of the Table, let him first moisten the Table, and he shall find no great alteration: Secondly, if the water should alwaies fall downward, and so stil run abroad, and spread it selfe to the margents of the Table, it would follow, that if the Table were of an infinite capacity, the water thus shed, would infinitely flow abroad, without intermission; and so should Nature set no bound to the thicknes and motion of the water: whereof experience hath sufficiently taught the contrary. Now, that water thus standing still on a plaine æquilibrated Table, should haue a *Conically* figure, it may be plainly proued almost by sense, whereby we perceiue the middle to be higher then the extremes: for no man can deny but the water thus standing, is endowed with thicknes, forasmuch as it is a naturall body. Wherefore of necessity it must swell aboue the Table. It cannot be *Spherically* *Concentricall* with the whole Earth, because in so small a segment of an Arch, as this little quantity of water admits, it would be insensible. It cannot be plaine, because the sides or extremities of it touch the Table, whereas the middle *superficies*, by reason of the thicknes, is eleuated aboue the Table. Neither can we imagine another figure besides, which can aptly be admitted: It is meet in the next place, that out of the grounds of Philosophie, we explaine how it comes to participate this figure: where we are first to understand, that the figure of the water is (as it were) composed of two spheares; whereof the first is imagined to be *concentricall* with the whole Earth; the other lesser onely answering to the portion

or quantity of water, were it made round; for if we consider the simple and particular nature of the water, we shall find it inclining to roundnes of it selfe, as we haue shewed by experiment; yet such a sensible roundnes, as cannothauue one *Center* with the Earth. But if we consider the water as it concurses to the constitution of the whole Vniuersle, we shall find this Figure to partake of a *circular segment concentrick* with the whole Earth. Now because neither of these two Figures can precisely and exactly arise by it selfe, sith the one must needs somewhat alter the other, we must of necessity admit of a figure mixt and compounded of both these; which can be no other then a *Cone*. To expresse this more plainly (because this path is yet vntrodene), we find in the water a double motion directed to this double figuration. The first whereof is that, wherby all the parts of a quantity of water, are inclined to an Absolute roundnes, or Sphaericall Figure, without respect of the Vniuersle, the Center of which roundnes, is to be sought in the water it selfe. The later is that, whereby the parts of the Water conforming themselves to the Center of the Earth, as neare as they can, make a Sphaericall figure (as much as Nature can suffer) concentrick with the whole Terrestriall Globe. In the former of these motions, the Water seekes it's owne preseruation; in the later, the safety of the whole Vniuersle; for the safety and consistency of the whole, is derived from the parts which concurre to preserue the whole. To expresse a litle better the maner of these two co-current operations, we will take for an vndoubted ground, *That God hath giuen to Nature a power and inclination to preserue her selfe.* This granted, we must distinguish of a two-fold preseruation: the one *Speciall*, wherein every Body seekes it's owne safety: the other *Generall*, wherein all Bodies concurre to the preseruation of the whole. The former proceedes from the Speciall Forme and Nature of every Body; which is performed by the vniōn of all his parts to it selfe; this vniōn is greatest of all in a Sphaericall figure, wherein all the extreme parts are equally distant from the Center, admitting no *Æquality* of dimension. The Generall depends from the Resultancy and

Harmony of all the parts, whereby is caused an vniōn of all the parts with the whole; to whose preseruation they are secondarilē directed: whence ariseth a double figurature of the water; the one of a Spheare, excentricall with the Earth: the other also of a Spheare, but concentrick with the Earth; wherof this Conicall figure is cōpounded. Why this figure should be more sensible in a small drop or quantity, then in the Ocean, may be declared from the same ground well vnderstood; because the convexity of the lesser Spheare excentrick with the Earth, is more; and of the greater, is lesse: for by howmuch lesser is the Spheare, the greater wilbe the convexity: and by howmuch greater the Spheare, the lesser wilbe the convexity, or crookednes. Wherefore this crookednes being in a small measure of water very sensible, in a maine Ocean will by sense be hardly distinguished from a right line.

8 Of the Figure of the Water vvee haue spo-
ken: We must nowv speake of the Quali-
ty, vvhich is tvvo-fold: Saltnes, & Thick-
nessc.

1 *The Water of the Sea is salt, not by Nature, but by Accident.*

That the Sea is of a saltish Quality, no man hath euer doubted, at least in most parts: But whither this saltish Quality, essentially agrees to the center of the Sea, as therem created, or else Accidentally brought in, I find no small difference among Philosophers. Those which defend the saltishnes to be Accidental, are diuided into diuers sorts: for some of the old Philosophers imagined, that the Earth chased and Heat with the Sun, continually sweateth out water: whence is made the Sea, & therfore should haue a saltish taste, because all sweat is of this Quality: But this opinion I take to be no other then a pleasant Allegory of the old Greeke writers, who wrote their Philosophy in verse, & therfore vsed such allusions; as we shall perhaps find in many other matters, poētically deuised

of them; yet refuted of Aristotle in good earnest: others haue more probably conjectur'd, that this saltishnes was first derived from the Earth, through whose parts the Water being strained, is apt to receiue this Quality, being primarily in the Earth it selfe: as we see water being wrung through ashes, to grow salt: but this opinion seemeth of no great soundnes; because the first Riuers and Lakes being drawne out of the Earth altogether, and in regard of their small quantiry, more apt to yee'd and receiue this tincture, are notwithstanding de-voide of all such Quality. Besides this, we rather find the con- trary by experiment: That Sea Water strained through clay, will turne fresh: as likewise powdred flesh being layed to soake in salt water, will soone turne sweet: The former is ve- rified by *Baptista Porta*: of the other, euery kitchin made on the Sea side will informe vs. The third opinion is of Aristotle, who referres the saltish quality of the sea water to the *Sunne*, as the chiefe cause, drawing and lifting vp out of the Sea store of exhalations, which afterwards mixt with vapours, fall down againe by drops: for the *Sunne* drawes vp the thinner and fresher parts of the water, leauing the thicker and lower water to suffer aduision of the Sunne-beames, and so conse- quently to become salt: so that the matter of this saltishnes in the Sea, is an exhalation: the Sun drawing vp to the middle Region of the Aire, the fresher parts; where thickned, they descend in raine, leauing the residu of the Sea salt. The forme is the straining and concoction, which is made by the Sun; for the saltishnes is said to arise out of the commixtion of Terre- Atriall drynesse, concurring with moisture, join'd with aduision of Heat: so that two things are chiefly concurring to the Generation of saltishnes; to wit, Drouth and Aduision. This seemes to be prooued by instance of Fresh-waters in the kit- chin, which turne salt, being much boyled, because the thinner and sweeter vapours of it are drawne vp, & dissipated, leauing that behind which is thicker & saltish. The same would some haue in the Sea, seethed (as it were) & burnt with the Heate, which we experimetally find in hot water on the fire. But this is excepted against by some, because we find by experience,

that many salt wells and fountaines arise in diuers places of the Earth, which are ingrendred in the bowels of the Earth, farre remore and separate from this extreame heate and aduersion of the Sunne-beames: But to this we may easily answere, that such salt springs are either by some violence enforced from the sea by certaine secret cavernes, and hollow places of the Earth: or else that they receiue their tincture of saltnesse from some salt minerals of the Earth, through which they passe. Wherefore this opinion of *Aristotle* I see not yet sufficiently refuted. The other opinion concerning this quality of such, which would haue it esentiall to the sea wa-
ter, and inbred in the first creation, is grounded on two finall causes: First they say that the sea is salt, for the preservation of the Fishes, who would otherwise rot, because experie-
nce shewes, that Fish will soone putrifie without salt; but this is thwarted by three reasons: First, because if fish were in this sort salted in the sea Water, the cooke might save him-
selfe a labour in salting them againe in his kitchin: Also Fishes caught in the sea, are oftentimes preserued longer and sweeter, lesse needing salt then those which are found in fresh Ponds and Riuers: Secondly, if this reason should hold cur-
tant, why should not the Fishes also rot and putrify in fresh Water? Thirdly, why should fishes covet the fresh Water (as we see by experiance in many fishes) if in it they should suf-
fer putrefaction, which is a great enemy to nature; Aboue all what need we feare this putrefaction of fishes, while they are endowed with a living soule, which is a greater preser-
vative then all the salt in the world; or why should we not doubt the same calamity in all liuing creatures in the land, which are as subiect to rotteness in the Aire, as the other on the land? The second cause (say they) Why the sea should be created salt, is; Because the sea it selfe should not putrify, forasmuch as we find by experiance, that salt is the only thing to resist Putrefaction; But heere we may demand; why these Authors should feare Putrefaction in the vast body of the sea, rather then in other Waters and Rivers, which are neither salt, nor come neare the greatness of the Ocean;

whereas *Aristotle* affirmes in the fist chapter of the 4 booke of his *Meteors*, that if the sea were divided into many parts, it would more easily dissolve and putrify. The grounds of this opinion being overthrowne, there want not reasons to contradict: First (s ayes one) if the sea were not created salt, then was there some time wherein it was fresh: To this I answere two waies: First, that it might be created fresh, yet being apt from the heat of the Sunne to receiue saltnesse, it might, almost at the first receiue it. Secondly, if I should graunt that it was a long time before it embraced this quality, I knowe neither Historie to confute me, or reason to convince me. Secondly, it is vrged from the Nature of living creatures in the sea, that they cannot well liue in fresh waters, and therefore it seemes originally salt, and not by Accident: But this is of no great force: First, because experience shewes, that many kind of fishes liue in both, and many rather covet and desire the fresh Water, then the sea: Secondly, it is not improbable, that as the sea by litle and sitle and by degrees turned from freshnesse to saltnesse, the temper and disposition of the fishes, was in like manner changed and altered: Whence it may come to passe, that fishes since bred and nourished in fresh Waters, cannot so well endure the salt. Moreouer who knowes whether all these severall kind of fishes now found in the sea, were from the beginning, since we see by experience, that sundry kinds of living creatures daily arise out of putrefaction on the land, which may with like probability, or more, be admitted in the sea. There are yet behind other reasons of one *Patricius a Platonist*, who would oppose *Aristotle* in good earnest. *Aristotle* (saith he) speaking of the saltnes of the sea Water, shewes not the cause. For I would aske, why that parcell of water, from whence the thinner parts are extracted, should remaine salt; was it so from the beginning, or afterwards imprest; was it *Inbred*, or *Accidentall*? If he would haue it an inbred quality from the beginning, he vainly goes about to seeke out the cause; If the saltnesse be adventitious, the cause is to be giuen; but the cause giuen by him, is not true, for asmuch as it rather takes away the saltnesse: But to

these obiections of *Patritius*, spunne out in many words, we may answere two waies: either that the saltnes is merely adventitious bred by an exhalation, drawne vp by the Sunne, and so distilling downe againe; or else, because this answere seemes not wholly to satifly. (Forasmuch as rainy Water is seldome salt, and if it were, could hardly flow in so great quantity to feed the saltnes of the sea): I will answere secondly, that the saltnesse is radically or originally in the matter of the Water; yea so, as it cannot be drawne out and sensibly be perceived in the mixture of many sweet humours, joyned with it, without a separation first made by the heat of the Sun of the thinner parte from the thicker: So that the Sunne is a disponent, though not a productiue cause of this saltnesse, in the sea.

2. Seas absolutely salt, are neuer frozen.

This may seeme a *Paradoxe* to some men, in regard that amongst our *Geographers*, we haue so often mention made of *Mare Congelatum*, taking it's name from the Ice wherewith it is shut vp from passage: as also for that in the voyages of *Frobisher*, *Davis*, *Hudson*, and other later Navigatours, which haue bin imployed in the search of the *Northwest* passage, we find such strange relations, not onely of Seas closed vp with Ice, and hindring their passage towards the North; but also of *Rockes* and *Illands* of Ice, of an incredible greatness. The truth of these Relations I no way disapproue, but rather out of these testimonies, approue our former assertion; that Seas which are wholly *Salt*, are neuer found to freeze: For first whereas it is called *Mare Congelatum*, it may beare the name well enough from the multitude of Ice floating on the water, or collected into a Rock or Illand. This Ice (as it will easily appeare) is not produced out of the substance of the Salt water of the maine Ocean, but rather carried into the Sea by great riuers of fresh water running into the Ocean: For the riuers are not alwaies frozen; but sometimes by a remission of the cold are thawed, and the peeces broken asunder, and floating into the Sea, in it oft times meet in great heapes, which may be proued: 1. In that these great rocks of Ice melting with the heat

heat of the Sun, haue dissolved into fountaines of fresh wa-
ter, gushing downe in great abundance, wherewith somtimes
in case of necessity, they haue fraughted their shippes, as we
haue testified by the fore-named Nauigatours. 2. Because
some part of the maine Sea, situate perhaps more Northerne,
and in a colder Climate, suffers not this accident: whereas
places neare the shore, farther South, are almost alwaies fro-
zen: The reason whereof, is; because the Sea neare the shore
is commonly mixed with fresh waters, conveyed in, either by
great Riuers, or infinite secret passages vnder ground, which
we see not: The reason why that salt waters exclude this pro-
prietie incident to the fresh, I take to be the *Hot spirits*, hid in
the salt humor, which are more seruent and operatiue, then
those of the fresh water.

9. Somuch for the saltnesse: The next, is the
Thicknesse: whereof we will set downe this
short Theoreme.

1. *The Water of the Sea is thicker then other
Water.*

This Proposition hath it's light from the former: because
thicknesse of Water is a companion of the saltnesse, as depend-
ing from the same cause, to wit, the exhalation, and extracti-
on of the thinner parts of the Water. There are many finall
causes giuen by *Patricius* of this thicknes of the Sea Water.
First, because the parts of it should more strongly hold toge-
ther, and not couer and overflow the firme land: But this
seemes to be grounded on an errour, that the Water should
be aboue the Land; and that it should containe it selfe within
it's own bounds and limits, which opinion we haue elswhere
refected. The second cause of the thicknes of the Sea, is; that
it might be more apt to beare and carry ships, and other great
weights for the vse of man. Thirdly, the Water being thicke,
may more easily be converted into *salt*, out of which, many
saltish minerals in the Earth are ingendred. Other causes are
giuen

giuen by this Author, but lesse forceable', which we will o-
mit, as referring them to the Philosopher, whose proper taskē
it is to seeke them out.

C H A P. VI.

Of the Motions of the Sea.

1 **H**e Motion of the Sea, whereof we are in this Chapter to treat, is either *Naturall*, or *Violent*. The *Naturall* I call that, which is partly inci-
- dent to the *Naturall Disposition* of the Sea.

2 This againe is two-fold, either *Generall*, or *Speciall*: *Generall* is that which agrees ge-
- nerally to all, or at least to most parts of the Sea: such as is the *Ebbing* and *Flowing* of the Sea.

We must here obserue, that the Water hath a two-fold Motion; The first is common to all heauy Bodies, as well as the Earth, in which is an inclination to come as neare as they can to the Center of the Earth, whereof we haue spoken in our former booke: The second is that which more properly agrees to the Sea, which is againe two-fold: either the *Naturall*, or the *Violent*. The *Naturall*, howsoeuer requiring per-
- haps the concurrence of some externall cause, is notwithstanding so called; forasmuch as it chiefly seemes to proceede from the *Disposition* of the Sea-water; The *Violent* is caused merely by the violence of the windes moving the Ocean. The

• Naturall motion we haue again diuided into Generall, or Speciall; because : he *Afflxe, & Reflxe* of the Sea , whereof we are to treat, is generall throughout the whole Ocean, (some petty creekes perchance excepted) whereas the Currents, (which is the second kind of motion) are more speciall, as agreeing not to a l, or most parts (as it seemes) but to some one or other speciall place, as we shall shew.

I The Sea twice every day ebbes and flowes.

The flowing and ebbing of the Sea , howsoever it cannot be precisely obserued in all Seas; yet because few places of the maine Ocean are exempted from it, deserves the first & chiefe st consideration. That such a motion there is, experience shewes; but the searching out of the cause, is, for ought I can obserue, one of the greatest difficulties in all *Natural Philosop-
hie*: insomuch as *Aristotle* one of the acutest Philosop-
hers, is reported to haue stood amazed at the flowing and ebbing of *Enripi*, and despairing of finding out the cause, at length en-
forced to cast himselfe into the Riuier which had be ore con-
founded him. Wherefore it may seeme sufficient for me to
trace their steps, who haue waded far into the search of this
cause, hauing very little hope to goe further. The first opinion
was of the *Stoikes*, who supposed the whole World to be a
great liuing creature, composed of diuerse Element , which
injoyes both breath and life: This liuing creature they ima-
gine to haue his nostrils placed in the maine Ocean, where by
drawing in, and sending foorth breath, the obbing and flowing
of the Sea is caused: but this seemeth rather to be a poëtical
fiction, or *Allegory*, then any conceit of a Philosopher. *Apollo-
nius Tianaus* was of an opinion, that certain Spirits either vi-
nder, or aboue the Water, breathed into it this motion. *Timaeus*
taught the cause of this moisture to be the riuers breaking in-
to the Ocean by the great mountaines; *Plato* thought that it
was made by the swallowing vp of the Sea into a gulfe or
hole, which being againe cast out, was the cause of that mo-
tion in the Sea. *Selencus the Mathematician*, which affirmed
that the Earth was carried round with a perpetuall motion,
thought

thought that the Moone was turned round with a motion contrary to the motion of the Earth; and from this to proceed that motion of ebbing and flowing of the Sea, whereof we now treat. What *Aristotles* opinion was concerning this matter, is an vncertain conjecture; forasmuch as little or nothing can be gathered touching this point in controversy out of any booke, which is certainly known to be *Aristotles*: for the tract of the propriety of Elements, where the cause of this motion is ascribed to the *Moone*, is judged to be none of *Aristotles*, but of some later Author. Yet *Plutarch* imposeth on *Aristotle* this opinion; that this motion of the Sea should come from the Sun, because by it are raised vp many windy exhalations, which should cause the Sea to swell, blowing into the great Atlantick Ocean. But this opinion is charged by *Patricius* of a threefold error: 1 That it should proceed from the *Sun*; 2 From the winds; 3 That it is only in the *Atlantick* Sea. He saw (saith *Patricius*) that in the *Atlantick*, which he could not in the *Egean* Sea at home and neare *Athens*. For 1 No wind blowes so regularly, that for one six houres it should blow forward, the other six houres backward: for the wind oftentimes blowes many daies the same way without ceasing; yet is there not one only flowing or one ebbing in the Sea. 2 The *Sunne* stirres vp sometimes windes, and sometimes stirres them not vp. But of a perpetuall effect which is daily, why would this Philosopher give a cause merely violent, and not quotidian, which notwithstanding would haue nothing violent to be perpetuall? If the Sea be somewhere moued naturally by other motion; as the *Euripus*, (which is said to be his death) wherefore will he deny this motion to be *Naturall*, seeking out an externall cause of this effect? But all this while our *Platonick* Philosopher seemes to fight with shadowes: for what judicious man can imagine so judicious and wise a Philosopher as *Aristotle*, should so grossly overshoot himselfe to fater this opinion? I should much rather believe that no such opinion is to be found in *Aristotle*, at least that it is indirectly related: which I the rather believe, because one *Casalpinus* a late Writer, aswell opposite to *Aristotle*, as the

other hath related Aristotle's opinion otherwise; to wit, that the ebbing and flowing of the Sea, is derived from a double cause: whereof the one is the multitude of Rivers bringing in a great force of waters into it: whence it comes to passe that it flowes only towards one part, which is the lower, as it happens to the Mediterranean; For the *Ægean* and *Pontick* Sea, with *Meotis*, flow into the *Tyrrhene*, and not on the opposite side: The other cause he makes to be the *libration* of the whole Sea: for it is often turn'd from one side to the other, which in so great a vastnes seemes but little; but in straights & narrow places much more. So that Aristotle (saith *Casalpinus*) would haue that to agree to the Sea, which vsually happens to a paire of ballance: which hauing received the beginning once of their motion, are inclined sometimes this way, & sometimes that way, by reason of the equality of the weight: for if the weight on one should ouercome, the whole would incline that way, and would not rise vp on the other side. But against this opinion imposed on Aristotle, *Casalpinus* not without good reason, excepts, that the *Superficies* of the Water being *Æquidistant* from the Center (as is supposed by *Geographers*) no reason may be giuen why it should incline more to one side then another, hauing once obtained his true place: sith according to Aristotle's own grounds, no violence can be perpetuall. To which I may adde another answer, that no satisfactory reason can be alledged, why it should alwaies obserue so true and just periods of time in it's motion: sith all Rivers are sometimes encreased, and other times diminished according to the season of the yeare, and variety of the weather: wherefore the said Authour, which impugnes this opinion, hath framed another conceit, grounded on the *circular* motion of the Earth, which he explaineth in this sort. It agrees to reason (saith he) that the Water should not altogether follow the motion of the Earth; but should in part be driuen back, and in part flow besides: for since it is of a moist nature, while the Earth is carried from the Aire about it, the Water is somewhat left behind; as wee may see in a small vessell, which is more large then deep: for if it be moued forward, the

Watet

Water will leap back to the opposite part, & will oftentimes poize it selfe hither & thither, seeking an æquilibrium: when therefore the Earth is a litle caried forward, & the water (as it were) left behind, being out of his *Æquilibrium*, or æquall poize, it will run to the other part, but beyond the true poize; for the violence of the motion impressed into it in the beginning, from the same, for the same cause, it will tend againe to the opposite part, doing this oftentimes, seeking an æquall weight, wherein it may rest: so that if the Earth should at any times rest from her naturall motion, the Water would also leau off the *Libration* to and fro. But because the circumvolution of the Earth is imagined to be perpetuall, the libration of the sea is also perpetuall: so far forth then that this motion is of the continent or Earth, it is only accidentall in the Water, neither besides his proper nature, neither according to nature: But so far forth as the Water is in some sort moued in the Earth, it may be said to be according to nature: for it alwaies seekes the lower place, because it cannot æqually follow the motion of the Earth. Hence they give the reason, why this motion is not perceiued in Lakes and Riuers, as well as in the maine Ocean: for sith the motion of the Earth is not very sensible, it cannot be perceived but in a great masse of waters. The reasons to confirme this opinion, besides the refutation of other opinions, are chiefly these two. If the Water by it selfe should be mou'd without the motion of the Earth, it must needs be moued either according to, or against his nature. But neither of them can be graunted; First, if according to Nature, there would not be one only motion of one body according to nature, but many, which is denied by Aristotle; If besides, or against Nature, some violent motion would be perpetuall, which also seemes absurd: wherefore it must needs follow, that the sea should move accidentally: For sith the Water is conteined outwardly of the Aire, internally of the Earth: And that part of the Aire which toucheth the Water is of Aristotle called *Stagnans* or standing still, not flowing, as that which it aboue the Earth, but is only troubled variously with windes. This libration or motion of the Water

cannot be caused by the winde or Aire, wherefore it must proceed from the motion of the Earth. The second reason may be drawne from the quantity of tides in divers places of the Earth, for it is found by experience, that the Water swels higher and greater in the *maine Ocean*, then in other *lesser Seas*: For it is observed, that about great *Brittaine*, it mounts sometimes aboue 80 cubits: also it oftner ebbes and flowes in lesser currents, because the spaces of this libration are shorter and straighter: or because besides the motion of ebbing and flowing, which the *Mediterranea* seas partake from the *Ocean*, at *Hercules Pillars*, they haue a proper libration in their owne channels: whence it comes to passe that in some narrow seas, as in the *Euripus*, besides *Euboia*, the sea seven times a day ebbs and flowes: whereof there can no sufficient reason be giuen from the motion of the *Moone* or other cause whereto other Philosophers ascribe this effect: This opinion of *Casalpinus* seemes to carry great likelyhood of reason and congruity with experience: yet because it is grounded on the circular motion of the Earth, which seemes a paradox to most men, I dare not warrant it otherwise then probable, neither can it well stand with the grounds of our *Magneticall* Philosophers, because they affirme the whole spheare of the Earth and Water together with the Aire to moue round with one *Uniforme revolution*, in such sort as one should not moue to the opposite part, or stay behind the other; as they would haue it heere to doe. There is yet another opinion more commonly defended in the schooles of naturall Philosophers; that this motion of the sea is to be ascribed to the *Moone*, as the principall cause: others againe, as they admit the *Moone* to haue her operation in this effect, ioyne other causes to it: and indeed this seemes more probable: for there want not arguments in *Patritius* and other later writers, to shew that the *Moone* cannot be the sole cause of this motion: First, because this motion is not observed in all seas, Lakes, and Rivers, whereon neverthelesse the *Moone* hath the like dominion: But experience shewes the contrary: for besides fresh Rivers it is manifest by observation of travailers, that this ebbing & flowing

flowing is not to be found in the *Hircan, Mantian and Dead sea*: also in *Maeotis Palus*, in the *Pontick, Proponticke, Egyurian*, and *Narbon streytes*, neither in the *Tyrrhene sea*: Moreover it is not obſerved in a great part of the *Red sea*: Neither can the *Norrownesse* of the channell excuse it, because these seas are great, and also for the most part within the *Tropicks of Cancer*, and therefore exposed sometimes to the perpendicular beames of the *Moone*. Secondly: If the *Moone* ſhould by her owne force excite and moue these waters, then would it moue those seas, which it doth moue, *Altogether and not only in parts*. The contrary whereof we may find: First in the *Red Sea*, which in the beginning and end, *Ebbes and flowes*, but in the middle not at all: moreouer the *Mediterranean sea* ebbes & flowes as one ſea, on all the coaſts of *Africa*, wherein it is in a ſort divided; and yet those ſeas, with which it is ioyned, as the *Tyrrhene, Egyurian, and Gallican Seas*, ſeeme not any ſuch motion. Thirdly, it is obieceted, that if the *Moone* were the only cauſe of this *Flux and Reflux* of the ſea, then those ſeas, which are ſaid in whole to moue, ſhould æqually flow in hight: but this is contradicteſt by expeſience: because ſome flow higher, and ſome lower. As for example: The *Adriatick ſea* in the inmoſt creekē neere *Venice* ſwells neere foure foote in hight: but the reſt of it, not aboue two foote: which increaſe is likewiſe obſerved in the *Aegean, Cretian, Ionian, and Cyprian Seas*, alſo the *Syrian and Egyptian*, even to *Tortue Ferina*: But from *moſis pulcher* to the *Herculean streytes*, it increaſeth aboue two foot in length: But without theſe ſtraights, the ſame Ocean by the coaſts of *Portugall and Bifcay, and France*, the ſea riſeth vſually to 15 foot in hight; and neare the coaſts of *Belgia and Brittaine* 18 foot: At the conſines of *Bristol* to 60, and thence to the borders of *S. Michael* to 50: But at the coaſts of *Aethiopia*, neare the *Atlan- tick ſhores*, it riſeth not higher then in the *Adriatick ſea*: But neare the Iſlands of *Madera, the Canaries, and S. Thomas*, it furpaſſeth not the hight of *Venice*: But in *America*, on the bithermoſt coaſt from *Florida, Sinus Mexicanus*, the coaſts of *Brasile, and Paria*, moſe then three thouſand leagues, even to the

the Magellane straights it increaseth almost to two Palmes bredth: but farther South to Panama, and all those Southern shores, the ebbing and flowing is of an excessiue hight, as may appeare by the coasts of Cambaia, India, and Taprobana: Thirdly, if the Moone by a naturall vertue should moue the Waters of the Sea, then would it moue the Ocean and the Mediterranean Seas in the course of windes, with the same Fluxe and Refluxe in the same windes. But this thwarts experiance, which is thus proued: The Mediterranean Sea, when as it flowes in the Adriaticke, Ionian, and Sycilian Seas, the Water flowes towards the Land, when the Moone is (as the Mariners speake) in Sirocco & in Maestro; but ebbes or flowes back from the Land, when it is in Graco atq; Garbinio: And contrarywise the Ocean swells when the Moone is in Graco & Garbinio; but aswageth it selfe againe when it is carried in Sirocco & Maestro. Fourthly, if the ebbing and flowing of the Sea should follow the Moone, then all places in the same distance should ebbe & flow alike at like houres. But the contrary is proued by an experiment of *Patricius*, who reports, that at the same houre places distant 20 degrees, haue bin seen to ebbe or flow alike, and the places betwixt also to vary and obserue no just proportion. Fourthly, if these Surges should be stirred vp by the Moone, then the same superficies of the Water the same houre should be carried by the Moone: but this is contrary to the obseruations of Mariners, who haue obserued, that on the Norman coasts, and that of Picardy to Callice, the Tide happeneth the ninth houre from Mid-night: but ten miles from the shore not a full houre, but at the twenty and sixt mile from the middle of the channell, and vnder the same Meridian at 22 houres. Fiftly, if the ebbing and flowing should proceed from the Moone, then shoule the Water at the same houres increase and decrease: but this is opposite to obseruation: for at *Venice* the Sea is knowne to flow sometimes for seuen, sometimes for eight; but ebbes in fewer houres. But about the mouth of the Riuier *Senega* in the Atlantioke, it is comming in foure houres, but goes not back vnder eight: so about *Gozumnia Ostia*, the Tide is comming

in seuenhoures, but goes back in fve. Sixty, if the Waters flow by the *Moone*, then shoulde they be drawne and carried by the light of the *Moone*: because all action is by a touching, and the *Moone* toucheth the Water by her light: but it is found by experiance, that at midnight, when the *Moone* is most distant in her light, our seas doe no lesse ebbe and flow then when it is present: & so the Seas neare the *Antipodes* doe ebbe & flow, when the *Moon* is present with vs. 7^{ly}, if the *Moone* were the onely efficient cause of this motion, then the same light being present the same agent moving, the same effect should necessarily follow. But we find that it produceth two, contrary one to the other: because in her ascent to the Meridian it is supposed to lift vp the water, but a little declining from the Meridian, it is thought to depresso & asswage the waters. 8^{ly} if this effect were ascribed to the light of the *Moon*, then when the *Moon* shines not, there shoulde be no such motion, because contrary causes produce contrary effects. But we obserue the same ebbing & flowing in the *conjunction* or *New Moon*, when she hath no light, as in the ful *Moon*, whē with ful face she beholds the Sea: for in both these times we haue highest tides. These & many more arguments are urged by *Patricius*, to shew that the *Moon* cannot be the cause of this motion in the Sea: of the other opinion, that this effect is ascribed to the *Sun*, amongst others, I find the chiefe patron to be *Telius*, who taught that the Sea was moued in this wise, because it would auoide the operation of the *Sunne*, fearing lest it shoulde be too much dissolued into vapours, and so perish. But this opinion seemeth farre more weake then the former. For first I would aske concerning this motion, wherein it is thought to auoide the *Sun*: he it, whether it be voluntary, or necessary? It cannot be voluntary, or a free action, because the Sea is no living creature, to which only such a motion is incident: If it be necessary, then it is Naturall or Violent: It cannot be Naturall, because according to *Aristotle*, one Body can haue but one naturall motion, but the Water being a simple Body, hath another motion to fall downwards towards the Center: wherefore it cannot also admit of this. It cannot be violent; first, because no violent

lent thing can be *perpetuall*: Secondly, no cause can be thought vpon *Externall*, which should cause this violent motion: and if any such cause there be found, then is not this of *Telesius* the first and principall cause, sith it is referred to a farther cause: Thirdly, no cause can here be shewne according to this opinion, why all other waters, as fresh Riuers, should not likewise striue to hide themselues frō the face of the Sun. Fourthly, he should give a reason why in the *Belgick* and *Armoricke* shores, which are far more distant from the Sun, the same motion is no lesse eminent then in *Taprobana*, which is subject to the *Torrige Zone*; and why in the Iland of *S. Thomas*, which is immediatly vnder the *Equatour*, there is not a greater working of the Water then at *Venice*. Fiftly, that which *Telesius* brings to confirme his opinion, is no lesse warrantable then the maine point in controveſie. In the Summer (saith he) the clouds are lesser, because the Sun raiſeth vp thinner vapours, which are easily diſſolued: But in the Winter they are lesse, because the Sun is of leſt force, and so raiſeth vp fewer vapours to worke vpon the Sea: But both these maters are proved false by experiance: first, because in the Summer we haue as great a working of the water as at other times: In the Winter also as great, or greater. Secondly (saith the ſaid Authour) in the full Moone the motion is greater, because the much light arizing from the Moone, drawes vp many vapours. In the *New Moone*, because the Aire being refrigerated, the internall Heat of the Sea collecting it ſelſe, is made stronger with more vapours: In the quarters of the Moone, because there is not much light caſt from the Moone, and the Heat of the Sea is not ſo much collected by the externall cold of the Aire: To all theſe maters we may eaſily anſwer: First, how can the Moone beſtow any light on our Seas, when ſhe is with the *Antipodes*? Secondly, where he ſaith, that the internall Heat is gathered together, and made stronger by externall cold; 1 First I aſke how the Sea can ſend forth theſe vapours; if the vapours kept vnder doe raiſe the Sea vp; or if the Sea ſwell with theſe vapours in her womb, how can ſhe let them out? 2 How will he prove the Sea naturally to be hot, ſith it is

is one of the cold Elements? Thirdly, where he saith, that the light of the Moone is but in halfe imparted to the Sea; why should not the Sea proportionally in halfe be stirred vp? wherefore *Paricinus* and *Casman* finding neither the Sunne nor the Moone of it selfe to be a sole and sufficient cause of this motion, hauing joyned them both together in this causality, and added besides other particular causes: first (say they) there are two kind of causes concurring to that effect: either *Universall* and *externall*; or *Particular, internall* and next causes. The *Universall* caules are two; to wit, the *Sunne* and the *Moone*. The *Sunne* (saith he) with the heat of his beames and light doth *conserue, vivificate, and stir vp to action, the Internall and originall heat in all things here below*. This Heat being stirred vp and viviscated, all things are made fit for motion, and being so accommodated, are stirred vp to motion, as if from an *Internall* life they should be promoted to an *Externall*: for as in the *primary* life of things, the motion and action is shoun: in the *Essence*; in the *secondary*, the action and motion outwardly in respect of other things: so the first and originall heat of the Sea, cherished, and stirred vp by the external heat of the Sun, dries the Ocean, and moues it to action. The *Moone* also *cherishest, preserueth, vivificates, nourishest, and stirres vp to motion, all these earthly humours and moistures*: and as she dayly by houres beholds the Sun as her darling, & by him is (as it were) big bellied with lively seedes, so she beholdest her loue, the Ocean, dayes and nights, and fills the Ocean with these seedes which she receiuies from the *Sunne*. But this cannot be performed without her *motion*, without the diffusion of her *light*, without the effusion of her *influence & seeds*; wherefore it cannot otherwise be, but all our humours and moistures should be made fruitfull, conceiue life, bring forth, beare fruit, and be stirred vp to life and motion, by the motion of the *Moone*, through the *Aspect* of the *Moone* with the *Sun*, with the *Earth*, with the *Ocean*: wherefore all *lower* moistures are subject to the power of the *Moone*: Notwithstanding all are not equally vnder her dominio; sith all are not of the same substance, of the same Rarity, or density, or of the same Heat.

This much of the vniversall causes of the motion of the Sea, according to this opinion. The particular or nearer causes are such as are found in the Nature of the Sea it selfe: and these are two: the fluidty deriuied from the Radicall and first moisture; & the saltnesse drawne from the originall, & inbred Heat in the Sea. That is most subiect to the dominion of the *Mome, this of the Sun:* The saltnes therfore of the Sea seemes the nearest & most proper cause, & no other common Nature, why the Sea should be stirred with so many motions: for no fresh water is moved with so many, nor suffers any such Flux and Refluxe as the Sea. Then must the saltnesse be the nearest and most proper cause: But by what meanes doth it worke? It is answered by *Patricius*, that salt water hath in it more heat then any fresh water whatsoeuer; And though spirits be hid in all moisture; yet farre more in salt, then freshnesse: wherefore from these spirits existing in the salt humour, is the Sea turned and tossed with so many motions: amongst which, the chiefeſt & moſt remarkable of all is that of the *Ebbing & Flowing* of the Sea: for by these motions, the Sea as a Terreſtral Heaven, followes and imitates the ſuperior; wherefore it ſeemeth evident, that from ſuch a motion ſhould be deriuied the motion of the Sea. This opinion ſeemeth to haue great ſhew of probability, & to be more ſoūd then all the reſta: but whether it will in euery part ſatisfie, I much doubt: yet muſt we embrake it, vntill ſuch time as a better be found out.

2. *All ſeas doe not ebb and flow alike: Neither the ſame at all times.*

That a great diſparity is found in diſtinct places of the ſea, concerning the afflux and reflux of the Water, is maniſt out of many iſtances, we haue ſhewed in the former propoſition: it will be enough in this place, to giue ſome reaſons for this variety. This diſparity then is found to be two-fold; ſo: ſome ſeas neither ebb nor flow at all; others ebb and flow: Againe ſome ebb and flow more, others leſſe. Againe in reſpect of time we ſhall obſerue beſides daily coming and going

going of the Waters, Weekly and monethly changes, of all which branches we shall haue occasion to treate hereafter according to those foote stepps, which I find in the best writers. First therefore the want of this motion of ebbing and flowing in the sea, is by some Authors ascribed to many particular causes. 1. The Freshnesse or want of salt in the Water. 2 The Crassitude and thickenesse of the Water 3 The ouermuch thinnesse of it. 4 The extreame depth of it. 5 The narrownesse of the Channell: All which either ioyned together, or in part, may hinder, if not altogether take away, the ebbing and flowing of the sea in those parts: which we shall the better vnderstand, if we instance in some particular seas most remardeable: The Caspian sea is reported to be of this condition (although some haue doubted,) that it neither ebbs, nor flowes: This affection is imputed to two causes: First, The want of saltnesse; Secondly, the extreame depth: By the former it is vnapte to generate spirits, which should give a motion: And by the later, the Sunne-beames, which concurre to the stirring vp of these spirits, are hindred from piercing to the very bottome of the Water. That this sea should little partake of saltinesse, may easily be persuaded; forasmuch as 80 Rivers of freshwater, with 5 Lakes of no small quantity, are disburthened into this sea: Among the which are *Ochus* frō the East; *Cyrus* frō the West, *Araxis* from the South, falling into it with 40 Inlets; and *Volga* from the North, running into it with 70. Inlets. All which fresh Rivers, some of them exceeding great, must needs make this sea very fresh. To this may be added, besides the authority of *Contarenus*, confirming this by two other reasons: First the *Trouts* and *Lampreyes*, which is a kind of fish altogether delighting in fresh Water, are there taken in great abundance: Secondly, that on a certaine coast of it, the Water of it's owne accord congeales into salt: The reason whereof is, because salt Water mixt with fresh will more easily coagulate and congeale into salt. The depth of this sea is also sufficiently warranted by such as write of it, especiall the former named *Contarenus*. Secondly, the Lake called *Asphalte* is thought neither to ebb, nor flow: which besides these

reasons alleaged from the Caspian Sea, may be ascribed to the thickness of the water, not suffering any thing to sinke into it: So that for the crastitude of it, it must needs be heavier then other Water, and so, more vnapt for motion. Thirdly, it is recorded by some that in the inmost creeke of the Red sea, there is a motion: and so in the mouth of it, by reason of the Ocean; but in the middle no such matter is to be observed: which strange effect, some ascribe to the Thinnesse of the Water, (one of the causes aboue named) begetting fewer and weaker Vapours and Spirits: which either streight-way breath out, or are too weake to raise vp the Water. This thinnesse is confirmed to be in that middle part of the Red sea, not only out of the authority of *John Barro*, out of the experiments of *John de Castro*, which found this Water to be clearer and liker to Christall, then that of other parts; but also by the cleare perspicuity of it: For in almost all the sea may the bottome plainly be seene. Fourthly, we read the like of the Baltick sea: that it never ebbe or flowes, which *Bartholomeus Keckerman*, that countri-man, ascribes, 1. To the Marrownesse of the channell; 2. To the depth of it. 3. To the northerne situation: which cause I thinke he might well haue spared, considering that more Northerne seas then that, both ebbe and flowe. Fiftly: it is reported of *Maotis*, *Pontus* and *Propontis*, that they flowe from the one to the other, but never ebbe: For *Maotis* flowes into the *Pontick* sea as from the higher place into the lower: and the *Pontick* into the *Propontick*, and *Aegean* for the same cause, but returne not back againe. But besides this cause of this declivity of the ground, it stands with reason, that the Water should be fresher then that in other places of the sea: For first, all of them receiue into them many and great Rivers of fresh Water: for *Maotis Palus*, besides other, partakes of *Tanais*. Into *Pontus* fall according to *Arcanus* report about 52 fresh Rivers: whereof the chiefe are *Ister*, *Hispanis*, *Borysthenes*, *Tanais*, *Phasis*, all great currents. Secondly the forenamed fishes, which delight in fresh springs, are heere also found in abundance. Besides this freshnesse (if we beleue ancient writers, as *Pliny* and others) it is a sea of ex-

traordinary depth, so that for this cause some part of it was called *Negrifont*, or the *black sea*: Which blacknesse was by some, thought to arise from the depth of it: whereiu in many places, they could sound no bottome. Sixtly, it is testified of the *Tyrrhen*, *Ligutian*, and *Narbon* seas, that they suffer not this motion: The cause of which is only ascribed to the extreme depth, for few or no Rivers are disburthened into it, except *Rhodanus*: We are in the next place to shew, why this working of the sea is more in one place then in another: The reasons whereof (although many be thought on) are cheifly reduced either to the excesse of salines in the water, or the narrownesse of the channell, into which from an open place the sea is to be disburthened, or the shallownesse of the shore: All which either coocuring together, or taken by themselves apart, may cause the sea to swell more in one place then another; which may, as the former, be proued by diuerse Instances. Foure Seas are more particularly noted to flow and swell higher then other. The first is that compasseth about *Europe* from *Hercules pillars*, which according to diuerse shires, takes diuerse names; as the *Portugall*, *Cantabrian*, *Gallican*, *Belgicke*, and *British* Seas. And in the New World, or *America*, the Southerne Sea shalbe the second: The third is that of *Cambaya* and *India*: The fourth is that which compasseth about *Taprobana*: for the three last, the causes fore-specified, seeme manifestly to concurre: for *Taprobana* is reported by *Pliny* to haue a shore not aboue sixe paces deep, and the Sea to be greene and overgrowne with weedes, insomuch that the tops of the weedes fret their ships; and later Writters report, that the Land is knowne to augment the confines by reason of the shallownesse of the Water: so as we haue shewed that some Seas neither ebbe nor flow by reason of the depth of the channell; so on the other side must it follow, that other Seas ebbe and flow more by reason of the shortnesse and shallownesse of the shores: for of contrary causes proceede ordinarily contrary effects. Moreover it stands with experience, that in any Water or Sea, where the flood is stopped and hindred by quick-sands, it returneth with greater force, as it were enra-

ged, & swels so much the higher, which is the cause why in the coasts of *Cam'bia* it is listed vp so high, because the shores are so shallow, and so short, and expol'd to impediments, that in the ebbe, the Sea runnes backe many miles, and leau'e's the sands vncouer'd: Whence it must needes returne with greater violence. This also is found in the *Indian Sea*, and neare *Panama* in the Southerne Sea, where the Sea running back for two leagurs, certaine *lands* and *Lands* are left naked; so that in these three Seas here named, the Sea seemes to enlarge it's limits in bredth more then in other places; to which we may ascribe this effect. For the Seas about *Europe*, we may pronounce also, that for the most part they haue short & shallow shores, as may easilly appeare in the confines of *Engla*; But it may be objec'ted of the *English* shores, that they well very high, albeit the depth of the Water in the middle is found to be 144 foot: Here must we haue recourse to the other cause, the flowing of a large & wide sea into a narrow chānell: for the large torrents of water running swiftly into a narrow chānel, being hindred on both sides by the shores, frō spreading it self in bredth, is enforced to swell in hight: so that the effect is rather to be ascribed to the violence of a greet current, enbosoming it selfe into a streite chānel: which may more evidently shew it selfe in 2 instances: For in the streite chānels of *Zeland* and *Holland* it is listed vp about three foote: At *Bristol* in *Eng'land*, by reason of a greater force of Waters uniting from the sea into a more narrow chānnell, and seconded by the maine Ocean at the back, it swels to the hight of 60 foote: In the *Arm'rean* seas, where larger seas are emptied into more narrow streites then the former, it increaseth to 90 foote: Out of which experiments may we plainly collect, that to the increase of the motion of the sea besides the saltnesse of the Water, two other causes are concurring; to wit, the shallownesse of the shore, and the streitnesse of the chānnell, wherein a great and large sea is to be exonerated. This may lastly be farther illustrated from the disparity of these seas with others, for in the *Adriatick*, *Aegaeen*, *Ionian*, and almost all the *African* seas, the sea seldom swels to so great a measure: whereof

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the cause is aswell the *depth* of the seas, as the *equality* of the shores: for as the depth is a cause that somtimes it flowes not at all, and the in*equality* and shortnesse of the shore that it flowes high: so a meane hight of the Waters from the bottom, and a more *æquall* figuration of the coasts may be a cause of an indifferent working of the Water. Hitherto we haue shewed the variety of motion in the sea, in regard of the diversity of places: we are next to speake some thing concerning the variation of it in regard of the times, which, though it properly appertaine not to Geography, yet am I loath to leaue it out, because the discourse is pleasant. Concerning which point, the marriners make six degrees of change in the tides according to the times. First *diurnal*, whereof we speake in this discourse: The second *Hebdomedary*, or weeke-ly which *Possidonius* called monethly or weekly; because it is distinguished by severall weekes of a moneth: but tarries not till the end of the moneth: For it is found by experience of Navigatours that a day before the *coniunction* of the *Moone* with the *Sun*, and the day of *coniunction*, and a day *af-terwards*, the seas in the *maine Ocean* haue their greatest flowes and *ebbes*, being lifted higher and laid lower downe, & then the tides are most swift: The *fourth* day from the *coniunction*, the tide is lesse and lesse swift: The *fist* yet lesse then the former; and the *sixt* day lesse then the *fist*: But in the *seventh* day, which is a day before the *quarter*, and in the *eight* following, wherein it is *half-faced*; and in the *ninth*, which is a day after the *quarter*, the sea is, as it were, *dead*, not much stirring, neither much ebbing or much flowing; which was (as it seemes) only observed by *Pliny* in the *Euboian Etrypus*; but whether it so happen else-where, I leaue to men experienced in these matters: This motion as it doth *encrease* according to the age of the *moone*: So it is laid proportionally to *decrease* againe. The *third* motion is *monethly*, which seemes in the time of the *coniunction*, wherein the sea tides are highest and *swiftest*. The *fourth* is called *motus semestris* or *six-monthly*, happening at the times of the *Equinoctial*; differing one from the other like monethes: The *fist* is called *Trimestris*,

because it happeneth only in three mouthes distance. The last is *Annually* which *Patricius* witnesseth that himselfe saw in *Liburnia*, in the moneth of *January*. These motions I carelessly passe over, because the distinction seemes to me full of uncertainty and scarce warranted: and such experiments as are brought for the proofe of it concerne rather particular places, then the generall nature of the sea.

3. Hitherto of the generall motion of the sea.

The Speciall is that, which is obserued in some speciall places.

1. It is probable that the sea is carried some-
where from East to West, and some-where
from North to South, and contrariwise.

It hath beene a received opinion amongst Philosophers of this later age, that the sea by the rapture of the heauens should be moved round, as it were, in a diurnall course: which they haue laboured to prove by diuers experiments. First, because it is obserued by mariners that a ship can well saile from *Spaine* into *America* with an indifferent wind in 30. dayes, when she can hardly retorne vnder three moneths, which they ascribe to the circular motion of the sea: For a ship going from East to West sailes with the Water, but from West to East against the streme, so that the one must needs be swifter and the other slower. Their second experiment to confirme this point, is of a ship sailing from *Spaine* to *Holland*, which may as they say, swifter retorne back, then goe thither. To this motion of the Water from East to West, *Iu. lus Scaliger* hath added another, which he would haue to be from North to South, from *Terra Laboratoris* Southward. But *Patricius* not denying these motions, would haue many more in diverse Seas, not admittitg any vniverall circular motion enforced by the heauens, but various motions diversly disposed in divers Seas, for which he giues many instances, some whereof we will heere relate. First going about to disproue

Sea-

Scaligers opinion and experience, hee brings the experiment of the Portugall Nauigatours, who testifie that they came from *Mosambick* on the side of *Madagascar* into *Malabar* in 28, somtimes in 30, other times in 35 daies: which is farre from the accompt of Scaliger, who would not haue a ship to passe it vnder three moneths, out of which he laboured to proue this motion of the Sea, because the shippe was longer a going then returning. The seconde xperiment he takes from the obseruation of one *John Eupolius*, who willing to passe from the port of *S. Blasius*, which is beyond the *cape of good hope* in *Africk* to *Melinde* towards the Indies, could not goe forward by reason that the currents, (as they call them) drove them back from *Melinde* to *Pate*, a towne by this side of the Indyes: whence he would conclude that the Water should in this place rather runne from *West* to *East* towards the *Indies*. The third experiment is drawne from the testimony of *Thomas Lope*, who when he was to passe from the *Cape of good hope* towards the *Indies*, testifies that the current of the Water was so violent, that it ofteentimes leapt into the fore part of the shippe. The fourth is from the testimony of *Iohannes Guistanus*, who putting forth from *Tidor*, came into *Spaine* before the sixteenth moneth: This iorney from *Tidor* to the *cape of good hope*, containes 55 leagues, which makes 1650 miles: from this to the lland of *S. Helena* by the relation of another pilott are 1400 miles: from whence to the *Æquinoctiall* circle are 1500 miles: from hence to *Spaine* by the computation of degrees, are not aboue 1520 miles: of all which the summe is, 7114. Now if we take out of sixteeene moneths 49 dayes, wherein the ship against the *cape of good hope*, was carried hither and thither (which the mariners call *Voltegiare*) & 70 other daies wherein it stood still in the coasts of *Gninea* in *Melacia*, there will remaine a whole yeaer spent in this iorney: which dayes if we divide by those 7114 miles, there will be allotted to euery day no more then 19 miles. which evidently shewes that this iorney was most short in respect of the swiftnesse of the Nauigations. For if the Ocean should draine his current

to St Helena even to the west, they had ended their iourney in a far lesser time, because those currents (as they say) carry the ship. But this journy was accomplished very slowly : wherefore the currents were not carried from *East* to *West*, as *Scaliger* relates. Likewise from sundry other experiments, he goes about to proue that it constantly cannot be obserued to flow from *North* to *South*, as the said *Scaliger* affirmes, but that it is various according to diuers places. Neuerthelesse, that the Sea should haue a perpetual current from the *Poles* towards the *Æquator*, seemes to stand aswel with Reason, as Experience: For all men must needs coalesce, that the motion of the Heauens vnder the *Æquator*, must be much swifter then nearer the *Poles*, because the circles of it are greater neare the *Æquator*. Now by howmuch swifter the motion of the Heauen is, by so much more is the Rarification of the *Aire*, or other Elementary bodies right vnder it: whether it be *Aire* (as it is most probable) or *Fire* as *Peripateticks* imagine: But howsoeuer we determine that controveſie, it must needs be that the *Aire* must suffer Rarfaction, answerable to the swiftnes of the motion: if not immediatly by the swift motion of the Heauens, yet by a consequent by the greater feruour of the *Fire*, which vnder the *Æquator* must needs be greater and of more force then about the *Poles*: whence the parts of the *Aire* vnder it, must partake more degrees of Heat, and by necessary conſequence ſuffer a greater Attenuation. 2 The *Sunne-beames* being darted perpendicularly, cannot choose but attenuate and rarifie the *Aire* more vnder the *Line*, then in places more declining to the *Poles*. This ground thus laide, these two conſectaries will follow: 1 That the *Aire* thus attenuated, must needs take vp a larger place then it before possessed, which cannot be but by inlarging it ſelf towards either *Pole*, either *North* or *South*; whence the parts of the *Aire* in thole places must be more thickned and condensated. 2 That thole parts of the *Aire* carried towards the *Poles*, and meeting with the cold Regions of the *North* and *South*, must by condensation turne into water, and ſo fall down in *Raine* or *Snowes*; whence the Water

CHAP. VI. OF THE SEA.

increasing neare the Poles perpetually, must haue a perpetual current towards the *Æquator*, where they are againe exhausted in vapours by the Heat of the Sunne; in such sort, that as well the parts of the Sea betwixt themselves, as the waters in regard of the *Aire*, may proportionally maintaine themselves by mutuall transmutation. To this reason some haue added another, that the *Sunne* sojourning in the *Southerne Signes*, is nearer to the *Earth*; then when he is in the *North*; by the whole *Latitude* of his excentricke, and therefore of greater force to draw the water toward the *South*: But whether this Reason be of any great force, I will not spend time to dispute; let every man vse his own judgment. It seemes to me a conjecture not improbable, that these currents may be also varied according to diuers seasons of the yeare; as also according to diuers channels, by diuers crossings and doublings of the Tides, as we find in diuers places: but I will not be too bold in this opinion, because I loue not to walke without a guide in these vncertainties.

4 Of the Naturall motion of the Sea we haue spoken: It remaines we speake somewhat of the *Violent*: The *Violent* motion is that which is stirred vp by windes.

The consideration of windes is either *absolute* or *relative*: Absolute I call that wherein the Naturall effects and properties of the winds are handled; which properties belong to the naturall Philosopher, they being (according to Aristot.) a Naturall body vnpersectly mixt: The Respective consideration is that wherein the windes are considered in respect to the Terrestriall Globe. This Respect is again twofold; either in regard of the whole Spheare of the Earth, whereof they designe out the points of the Horizon by certaine lines called *Rhumbes*; or else in respect of the *Sea*, to which they giue a motion. The former respect we haue handled in our first book of *Geographicie*: The later is more proper to this place; & howeuer the wind is an exhalation, common aswell to the Earth

as to the Sea, affecting both with some alteration; yet because it more nearly affected the Sea as his proper Province and Dominion, and hath for the most part bin most obserued of Sea-men and Marriners; Wee thought fit to treat of it in this place. Of windes some are vncertaine and various, which in all places interchangeably supply their turnes, keeping no certainty or regularity in times or places: others are called, *set* or *standing* windes, because they are obserued to blow at certaine times and places: of both which, as much as concernes our purpose, we shal speake in these two Theoremes.

1. *To some certaine places, at certaine times belong certaine windes.*

These winds are by some, called *Anniversary* because they blow at a certaine season every yeare; of these there are many kinds mentioned by Nauigatours. The first and chiefeſt is that which they call the *Etesian* winde, which is obſerued to blow every yeare from the Northeast about the rising of *Dog-starre*, and oftentimes continues about 40 daies. This wind drives the Seas from *Pontus* into the *Agean* Sea, even ſo farre as *Egypt*. In the ſecond place may wee range ſuch windes as are called *Chelidonian*, because they arife at the first comming of the Swallows. It bloweth ſomtimes from the *Dirett west*, ſo that ofſome it is taken to be the ſame: Somtimes from the *North west*, ſo that with others it is accounted among the *North winds*: These *Chelidonian* winds driving from the *North* or *North-west* fill all the *Mediterranean* even to the coaſts of *Syria* and *Paleſtine*, and continue in the ſummer time for many daies together. In the third place may we accoſpt that winde, which *Columbus* perceived on the coaſt of *Portugall* comming ouer the *Atlantick Ocean*, which at ſome times of the yeare was carried higher, at other times cleaving (as it were) to the boſome of the Sea, whence he probably coniectureſt that it was derived from ſome moist land, whereon he aduentured on the firſt ſearch of *America* and laied the firſt worke of that diſcovery. Fourthly to these

winds

winds may be reduced those yearly flowings of the *Persian* and *Indian* Seas, which the Portugall mariners call *maricas*. The *Persian* Sea suffers such a kind of motion euery yeare, while the sunne runnes through the Southerne degrees, and when he arrives at the end of *Sagittarie* it is shaken with an extraordinary great tempest: On the contrary side the *Indian* Sea, while the *Persian* is moued, is observed to rest without any great motion; and when the *Persian* is still, it suffers great motion, especially when the Sunne fiftenterers into *Cancer*. This last motion seemes to be not only derived from the Provinciall windes, but some other concurrent causes: whether these windes are the cause of the currents before spoken of, is a very disputable point, which leaueth to others to search out. Of every set wunde blowing a part of the yere on the coast of *America*, *Acosta* treateth at large, to which he ascribes the currents foreshown in this chapter.

2. The violence of winds makes the Sea sometimes in some places, transcend his ordinary bounds.

How farre the sea by violence of windes hath trespassed on the land, many haue learned to their greate losse and calamity. It is obserued sometimes in the *Venetian* shores, that the Sea driven with windes swelles so high, that overflowing all the banks and channels, the Inhabitants are enforced to row in boates from house to house. Their cesternes are infected with Salt-water, and their pretious waters in vaultes and cellars spoiled. The like hath heretofore beeene found (if we will credit Histories) in the *Belgick* Sea, on which the Northwest windes blow with such vehemency and so long that it brake downe the ordinary banks; and in *Zealand* and *Holland* swal-lowed vp many townes with infinite multitudes of people. Which seemes to be warrantied by a report, I haue had of many travilers, that in a calme tide the topps of towres and steeples haue beeene scene above the water. Besides these instances, we may adde the testimony of *Strabo* and *Aristotle* in his

his booke *de mundo*: with diuers other relations of strange in-
undations whereof we shall haue more occasion to speake
heereafter.

CHAP. VII.

Of the Depth, Situation, and Termination of the Sea.

1. **H**e Absolute proprieties of the Sea
being hitherto passed ouer: we
will consider next the compara-
tive: which agree to the Sea no other-
wise then in respect or comparison with
the Earth, which are chiefly three; 1 *Depth*,
2 *Situation*, 3 *Termination*.
2. The Depth or Profundity is the distance
betwixt the Bottome and the Superficies of
the Water.

To find out the Absolute depth of the Sea, is a matter of
the greatest difficulty, and by many thought impossible,
in respect aswell of the inamenity of it in many places where
no line could touch, as of the various places, too many to be
searched out by mans industry: yet where absolute science
failes, there probable conjecture takes place, and is best accep-
ted, which we will venture to propose in this our Theo-
reme.

1. **T**he ordinary depth of the Sea is commonly
answe-

answereable to the ordinary hight of the
maine land aboue the water : and the whirle-
pooles and extraordinary depths answere to
the hight of the mountaines about the ordi-
nary hight of the Earth.

It hath bin a common received opinion among ancient Cosmographers, that the depth of the Sea being measured by a line and plummet, seldome exceeds two or three miles, except in some few places neare the Suevian shores, and some places about *Pontus* obserued by *Pliny*. But as *Breerewood* a worthy late writer obserues, this position is not to be vnderstood generally, but only of the depth of the *Streits* or *narrow seas*, which were perhaps only searched by the ancients who dwelt farre from the *maine Ocean*: But another accompt is necessarily to be giuen of the *maine Ocean*. This being a matter of great vncertainty, we will follow the conceit of the fore-named Author. It hath bin shewed in the former Chapter, that the most probable opinion concerning the manner of the first separation of the dry land from the waters, would haue the Earth by the Creation to be cut into diuers sluices & chānels, apt to receive Water. Now these materiall parts of the Earth, being taken out to giue way to hollownes, were not vitterly annihilated, but by an almighty hand set in some other places, making by their addition the *superficies* of the Earth in such places higher then before: whence by reason it seemes to be collected, that the ordinary Eminency of the hight of the Earth aboue the Waters, should be answereable to the ordinary depth of the Sea. And if Hills and Mountaines be compared, we may set them against the *Deepe* and extraordinary *Whirle-pooles* and *Gulfs*: And so betwixt the Sea and Land, and the parts of the one and the other we may settle a kind of agreement and proportion: In a matter of so great vncertainty, no man will expect an euident demonstration.

3 The Site is the position of the Sea in re-

O spect

Respect of the Earth.

Concerning the site of the Sea in respect of the Earth, we must consider the Water and Earth two wayes: First *Absol-*
utely as they are Elements and solide Bodies: Secondly, in re-
spect of the *superficies* of either: if we consider the whole so-
lide Body of the Water as that of the Earth, we must confess
without all doubt, that the Water hath the higher place, be-
ing lighter then the Earth; of which situation we haue spo-
ken in the first booke: for although some parts of the Earth
are thought (by most, as we shall proue) to be aboue some
parts of the Water, yet is this of no sensible proportion in re-
spect of that vast Massie of Earth, couched vnder the Waters
betwixt them and the Center of the World. But the question
is here of the *superficies* of the Water, compared to the *super-*
ficies of the Earth vncouered, which should be higher in place;
of which shalbe this Theoreme.

i The *superficies* of the Sea is some-where
higher then the *superficies* of the Earth,
some-where lower.

There hath bin a great dispute among Philosophers con-
cerning the position of the Sea in respect of the Land, whether
it be higher or lower: some haue bin of an opinion, that the
Water is higher; which opinion was defended by *Tully* in his
Book *De Natura Deorum*, where he saith, that the Sea being
placed aboue the Earth, yet coueting the place of the Earth, is
congregated and collected, neither redounding, nor flowing
abroad; which afterwards seems to be seconded by diuers lea-
rned diuines, who reducing most things to the supernaturall &
firſt cause, diuers times neglected and ouerſlipt the ſecond.
Hence *S. Basil* in his 4 Homily on the *Hexameron*, left the water
(ſaith he) ſhould ouerflow & ſpred it ſelf out of the place it hath
occupied, it is comanded to gather it ſelfe together: otherwise
what ſhould hinder the *Red Sea* to ouer flow all *Egypt*, be-
ing lower then it ſelfe, vniſle it were manied with the Cre-
ators power, as it were with fetters: to which also afterwards
ſeeme

seeme to subscribe *Aquinas*, *Dionysius*, and *Catharinus*, with diuers other Diuines, who held that the first discouery of the Earth, and the gathering together of the Waters in the first Creation, was made not by any mutation in the Earth, but by a violent accumulation of the Waters, being (as it were) restrained and bridled supernaturally, that they could not transcend certain limits and boundis. To confirme this opinion, some reasons are alleged by moderne Philosophers: first because it is the order of all the Elements amongst themselves, that the Earth, as the heauiest, should take the lower place, and the water should ascend above: Secondly, because Mariners comming from the maine Ocean to the Land, seeme to see the land far lower then the Water: Thirdly, they al-lege that place of *Job*, where God himselfe professeleth, that he hath bounded the Waters, in these words: *Hither to shal thou come, and no farther, & here shal thy proud waves be stayed*. But this opinion seemeth very improbable, that God in the first institution of Nature, that God should impose a per-petuall violence vpon Nature: sith we see the Creator in o-ther matters to vse Nature as his ordinary seruant, and to ad-minister the Regiment of things by second causes. Neither were the authority of these Diuines so great in these Cosmo-graphical concepts, to ouersway these of the same profession, who could more exactly iudge of these matters. Neither are these reasons of so great validity as to enforce assent. For first whereas St. *Basil* seemes to wonder why the Red Sea should not overflow all *Egypt*, if it were not supernaturally boun-ded; he takes that as granted, which is the question in contro-verte, that the Water is higher: for which he can produce no other reason, then the Testimony of the sense: but this is very weak, forasmuch as in such matters the sense is oftentimes de-ceived, as stands well with the grounds of the perspectives: for (as we are there taught) two Parallels will in the end seeme to concurre so far as the sight can iudge: Now the Spheare of the *Heavens*, and the Sphericall segment of the Waters being parallel the one to the other, will necessarily seeme to con-curre in the end: whence it must needs come to passe, that

that part of the Sea must seeme to list it selfe higher, and contrarywise the *Heavens* will seeme somewhat lower then indeed they are: and this I take to be the true cau'e why the Sea being seene a great way off, may appeare raised aboue the land whercon we stand. Another reason may be giuen from the perpetuall *Refraction* of the small Lixes comming from the Sea to our sight. For the Aire neare the Sea being alwayes intermixt with thick watrish vapours rising vp, the Sea must of necessity be presented in a thicker *Medium* by a refracted sight: whence consequently it must seem greater & higher then indeed it is: for as the *Opticks* teach, all things seem greater & higher in a thicker *Medium*. To the other three Reasons brought to confirme this assertion it is no hard thing to answer. To the first which would out of the order of the Elements inforce, that the Water is higher then the Earth; I answere (as before), that if wee intirely consider these Elements amongst themselues, wee must giue the hight to the Water; forasmuch as the greatest part of the Earth lies drowned; for that aboue beares no sensible proportion in respect of the parts of the Earth vncouered. But here we compare not the 2 Elements intirely betwixt themselues, but the *superficies* of the Water with the parts of the Earth vncouered, habitable: which *superficies* of the earth notwithstanding, this reason, may be higher then the Water: Secondly, where they produce the testimony of the sight; for my own part, I can warrant no such experiance, having never launched farre into the deeps; yet if any such experiment be avouched, it may easily be answered out of *opticall Principles*: that coming out of the main Ocean towards the land, by reason of the spherical convexity of the water, interposed between our sight, and the lower part of the land, those land parcels must needs seem less, as having some parts shadowed f.ō our sight: whence it must consequently appeare lower, as couched almost vnder water. Fro the 3^d reason grounded on *Scripture*, whereon our diuines seem most to depend, nothing else is concluded, but that Almighty God hath set certain bounds & limits which the Waters should not passe: These bounds & limits I take not to be super-

supernatural, as if the water restrained by such a power should contain it self within it's own circuit: But naturall as *clifts* & *hills*, within which, the waters seems intrenched. This opinion therefore being disliked, others haue laboured to defend an opposite position, that the water is lower then the Earth altogether: which opinion beares more consonancy with the doctrine of *rifts*, & most of our modern Philosophers. The reason whereon this assertio is grounded, be chieflie these: 1. If the Sea were higher then the Earth, what should hinder the water of it from flowing abroad, & ouerwhelming the Earth: sith all men will confess, that the water is by nature disposed to moue downwards to the lower place. If they haue recourse to supernatural bouds, besides that we haue spoken concerning the interpretations of such places of Scripture, as seem to favour this opinion; we answer as before, that it is very improbable, that God in the first creation should impose such a perpetuall violence: secondly, we read that in the vniuersall deluge wherein all the world was drouned, God brake open the springs of the deepe & opened the *Caracteres* of heauen to powre down raine continually many daies together vpon the Earth: Of which there had beene no necessity at all; had the sea beene heaped vp in such sort as they imagine: For the only withdrawing of that hand and letting goe of that bridle which gaue the Water that restraint, would haue beene sufficient to haue ouerwhelmed the whole Earth. The second reason is taken from Islands in the sea, which are nothing else but parts of the land raised vp above the water. Thirdly we find by experience, that a ship carried with the like winde, is driuen so swiftly from the port into the open sea, as from the sea into the port, which could not be donne if the sea were higher then the land: for it must needs be, that a ship if it were to be carried to a higher place, should be moved slower then if it came from an higher to a lower. Fourthly all Rivers runne into the sea from the inner parts of the land which is a most evident signe, that the land is higher then the sea; for it is agreeable to the nature of the water to flow alwaies to the lower place, whence we gather that the sea shore, to which the Water is brought from the land, must needs be lower; otherwise the Water in running thither, should

should not descend but ascend. This opinion I hold farre more probable as being backt by reason, and the Authority of our best Philosophers: yet not altogether exactly true (as we shall shew heareafter.) But *Bartholomeus Keckerman* a late German writer holding these 2 former opposite opinions (as it were) in one & quall Ballance, labours a reconciliation. In a diverse respect (saith he) it is true that the sea is higher, and that it is lower then the Earth. It is higher in respect of the shores and borders, to which it so comes that sensibly it swels to a Globe or a circumference, and so at length in the middle raiseth vp it selfe and obtaines a greater hight then in those parts, where in the middle of the sea it declines towards the shore: Of which parts the hight suffers such a decrease, that by how much neerest the shore they shall approach, by so much the lower they are in respect of the shore: in so much that touching the shore it selfe, it is much lower then the Earth. For this opinion our Author takes as a demonstration: which he grounds on the 4 chapter of *Aristotle de Cale*, in his second booke, where he puts downe these two positions; which he calls *Hypotheses*, or suppositions; First that the Water no lesse concurs to the making of a Globe or circle, then the Earth: for it so descends naturally, that it doth sensibly gather it selfe together, and makes a swelling, as we see in small dropps cast on the ground: Secondly the Water makes a circle which hath the same center with the center of the Earth: Out of these grounds would our *Keckerman* conclude the water in some places to be higher, in other places to be lower then the Earth: And hence proceeds he to giue an answer to their reasons who haue affirmed the Earth to be higher then the sea: What to thinke of the proposition or conclusion we will shew heareafter, but in the meane space I hold this conclusion not rightly inferred out of these premises: For first whereas he saith that the water by nature is apt to gather it selfe round into an orbe or spheare, I would demaund whether such a round body hath the same center with the world, or a diverse center: he cannot say that it hath a diverse center, from the center of the Earth: First, because (as we haue de-

monstrated in our first part,) the Earth and the Water haue but one center: and that the Water is concentricall with the Earth: Secondly, from the seconde proposition or ground of his, out of Aristotle; if he meane such a sphericity as hath the same center with the center of the Earth: I answere, first that he contradicte himselfe, because he giues an instance in small dropps cast on the ground, whose quantity being so small, and convexity sensible, can in no mans iudgement be concentric to the Earth. Secondly, out of this ground that the Spheare of the water is concentric to the Earth, he confutes himselfe; or according to the principles of Geometry, In a Spheare or circle, all the lines drawne from the center to the circumference must be æquall. Then must all places in the circumference or superficies of a sphericall body be of æquall hight from the center, and by consequence the sea being such a Sphericall body, cannot haue that inæquality which Keckerman imagines it to haue: Wherefore some other demonstration must be sought for this conclusion. I will goe no further then that I haue spoken in the former chapter concerning the figure of the Water: Where I haue probably shewed it to be *conicall*, and out of this may be easly gathered, how it may be higher then the land in some places, as of the middle of greater seas, where the head of the Cone is lifted higher; in other, lower; as in the narrow streits where the increase of the eminencie is also lesse. The grounds and principles of which we haue laid before.

I. *The sea in respect of the Earth is higher in one place then another.*

Besides the naturall conformity of the Water to a conicall figure, (as we haue fore-shewed) whence one part of the superficies must be graunted to be higher then another; we must needs in the sea acknowledge other accidentall causes, which produce an inæquality in the parts of the sea. The cheifest whereof are the Equality of inclination in all parts of the water to motion: And the inæquality of the channels and shores: whence it comineth to passe that the Water of the

sea being every where of it selfe & equally inclined to motion, is notwithstanding vn̄equally received into channels, so that in some place, hauing (as it were) a large dominion to invade, as in the maine Ocean, it falls lower and evener: In some other places as streites or narrow seas, the water hauing a large entrance from the Ocean, but little or no passage through it, must needs swell higher, and so one place by accident becomes higher or lower then another: Which farther to confirme diverse instances may be alleaged out of moderne and ancient observations. For diverse histories giue testimony that sundry Kings of *Egypt* by cutting the *Isthmus* or narrow neck of land lying betwixt the red sea & the *Mediterranea-*
n, laboured to make *Africk* an *Iland* & opena passage sīo one sea to the other: but afterwards they were perswaded to desist from their enterprise: Some say, because they saw the red sea to be higher then many parts of *Egypt*, and heereupon feare a generall inundation of all *Egypt*, if the passage were broken open: Others haue deliuered that they feared, that if the passage from one vnto another were broke open, and the red sea having a vent that way, the red sea would become so shallow that men might wade ouer it, and so instead of making *Africk* an *Iland*, it would haue bin more ioyned to the Continent then before. Both opinions consent in this, that the waters of the red sea were by the perpendicular found higher then in the *Mediterranean*: Moreouer it is obserued that the sea on the west part of *America* commonly called *Mare Del Zur*, is much higher then the *Atlantick* Sea which bordereth on the Easterne part of it: which gaue way to the conjecture of some, that the *Isthmus* betwixt *Panama* and *Nombr De Dios* had bin long since cut through to haue made a passage into the *Pacifick* Sea, without sayling so farre about by the straits of *Magellane*; had not many inconveniences bin feared out of the *inquality* in the hight of the Water. The like *inquality* is obserued by *Verstegan* in the sea betwixt *England* and *France*: For according to his conjecture, *France* and *England* being one Continent heretofore, and ioyned by a narrow neck of land, betwixt *Doner* and *Callais*

the

the water on one side was higher then on the other: which he probably collects out of the sundry flats and shallowes at this day appearing on the East side as well on the coasts of *England* as of *Flanders*, especially betweene *Dover* and *Callis*, called by some, our *Ladies Sands*, about three *English* miles in length: Out of which and sundry other probabilities, he labours to proue that all the *Low-countries* were heeretofore enveloped with the sea; till such time as the narrow land being either by *Nature* or *Art* cut through, and the Water allowed a free passage, it became *dry land*: but this point we shall discusse hereafter in place conuenient.

- 4 In the next place we are to consider the termination of the sea: The termination is the bounding of the sea within certaine li-
mits.
- 5 The Limit is the margent or border of land wherein any sea is circumscribed.

The sea is bounded by the land, as the land by the sea: In respect of which termination some seas are called *Maine seas*, others *narrow*. The maine seas are foure; to wit, the *Atlan-
tick*, which taketh it's name from the mountaine *Atlas*, by which on the west side it passeth, and diuides *Europe* and *A-
frick* from *America*. 2 The *Aethiopian sea* running on the west side of *Aethiopia*. 3 The *Indian Sea* hauing the *East Indies* on the North. 4 *Mare Del Zur* or the *South sea*, situate on the *South side of America*: Which foure in respect of other may be called *Maine Oceans*. The lesser seas are either called *Creekes*, or *streites*: A *Creeke* is a place where the water (as it were) embosomes it selfe into the land, hauing an entrance large from the Ocean, and most commouly streyned inwardly, but no passage through: A *Creeke* againe may be divided into the *greater* or *lesser*: Vnder the former in a large sense may we comprehend the whole *Mediterranean sea*: for as much as the sea from the *Maine Atlantick Ocean*

by an inlet is ingulfed into it, but findes no passage out any other way, howsover it invades a large territorie. The lesser Creekes are againe distinguished into the *Easterne* and *Westerne*: The chiefe Creekes found out towards the East are sixe in number. 1 *Sinus magnus* which lies betwixt *Mangus* and *India extra Gangem* reaching as farre as the region of *Chalcis*. 2 *Sinus Gangeticus* which is comprehended betwixt *Aurea Chersonesus*, and *India intra Gangem*. 3 *Sinus Canthi*, commonly called *Canthi-copuls*. 4 *Sinus Persicus*, bordering on *Persia*, and called by *Plutarch* the *Babylonian Sea*. 5 *Sinus Arabicus*, which is commonly called the *Red Sea*. 6 *Sinus Barbaricus*, which by *Pliny* is termed *Sinus Trogloditicus*, &c. at this day *Golpho de Melinds*. The Creekes lying Westwardly are chiefly these; First *Sinus Sarmaticus* lying towards the North, betweene *Denmarke* and *Norway*, which is diuided into *Sinus Finnicus* and *Bodicus*, which is called commonly the *Baltick Sea*. 2 *Sinus Granvicus* diuiding the *Misconites* from the *Corely* Northward; it is commonly called the *White Sea*. 3 *Sinus Mexicanus* bordering on the city of *Mexico* in *America*, amongst these, some would number *Mare Pacificum*, or *Mare Del Zur*: but this we thought fitter to call a *maine Sea*, then a creeke, being extraordinarily large in quantity. A *Strait* is a narrow *Sea* betweea two *Lands*; of such *Straits* these were anciently knowne, to wit, 1 *Fretum Gaditanum*, or the *Straits of Gibraltar* of 1 Miles distane, diuiding *Spaine* from *Barbary*. 2 *Fretum Magellanum*, found out by *Magellane*, which diuides *America Pernana* from the *Southerne land*. 3 *Fretum Anian*, situate betwixt the *westerne shore* of *America*, & the *Easterne borders* of *Tartary*. Besides these there haue bin discouered 3 more, (to wit) 1 *Fretum Davis*, found out by *captain Davis* in the yeare 1586, which lyes toward *Groenland*. 2 *Fretum Nasovicum*, or *Waygate*, neare *Nova Zembla*, discouered by the *Hollanders* in the yeare 1514. 3 *Fretum de Mayre*, found out by *William Schouten* a *Bavarian*, taking his name from *Isaac le Mayre*, by whose aduice and perswasion he vndertook his voyage. But some of these latter streits here mentioned, for ought I know, may better be reckoned amongst Creekes,

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Creekes, forasmuch as they haue not as yet found any passage through, though with great losse and danger they haue often attempted the Discouery. Concerning the bounding of the Sea with the land, we will insert these Theorems.

I. *The Water is so diuided from the dry-land, that the quantity of Water is greater in the South Hemisphere, of Land in the Northerne.*

That most part of the *dry land* is situate towards the *North*, will easily appeare by instance. For toward the *North* are placed the great Continents of *Europe, Asia*, almost all *Africa*, and the greatest part of *America*: But in the *South Hemisphere*, we find only a little part of *Africa* and *America*, besides the *South Continent*, which we cannot imagine to be so great in quantity, as it is painted in our ordinary Mappes; forasmuch as all places at the first discouery are commonly described greater then they are. The reason I take to be this, that the first draught is alwayes confused & vnpesect, where in a Region discouers it selte vnto vs vnder a more simple figure, neglecting curiosities; but after a longer and more exact search of any Region, will be found in many places ingulfed with divers *Bayes*, and variously indented; in such sort, as the bound Line compassing it round, making an inordinate figure, and lesse regular, canuoit contain so much land as first it might seeme to promise. Moreouer we may further obserue, that those places which in the first discouery haue bin taken for the main *Continent*, or at least for some greater part of Land, haue afterward vpon more curious examination, bin found clouen into many lesser *Ilands*: As in *America, Cuba* in the time of *Columbus*; and *California* of late, thought to be a part of the *Continent*, and so described almost in all our Mappes; yet since by a *Spanish Chart* taken by the *Hollanders*, discouered to be an *Iland*. The like instance we haue in *Terra del Fuogo*, which since the time of *Magellan*, was held a part of the *South Continent*, till *Schouten* by sailing round about

it, foûd it diuided from the main land by *fretum de Mayre*, carrying the name of the Master of the ship in his discouerie. Neither is it much to be doubted, but that in that large tract delineated out in the Globe for the *South-Indies*, are contained many Ilands, diuided one from the other by *streites* and *narrow Seas*, which must subtract much from the quantity of the dry land: so that of necessity it must be granted, that the *Northerne Hemisphere* takes vp the greatest part of the dry land as the other of the Water. Wherefore that place of *Esdras* where he saith, *That Almighty God allotted six parts to the Earth, and the seaventh to the Water*; must either seeme improbable, or suffer another interpretation then that of the ancients. For out of credible conjecture drawne from the view of the face of the Terrestriall Globe, we shall hardly collect such a proportion. In this comparison of the *Northerne Hemisphere* with the *Southerne*, we shall find a kind of harmony betwixt the *Heavens* and the *Earth*: For, as Traveilers report, the *Northerne* parts abound with more starnes, and of greater magnitude then the other toward the *South*; so the Terrestriall Spheare discovers vnto vs more continent, greater Ilands, and of more note, in the *North* then in the *South*.

2. *The whole Globe of the Earth is invironed round betwixt the East and the West with sea, dividing the North from the South.*

To proue this Theoreme we need goe no farther then the famous voyages of *Magellane*, *Drake*, *Candish*, and *Shouten*; Wheteof the first attempted, the first passage through *Fretum Magallanicum*, and gaue it the name, though he could not out-lie his intended iourney. The two next followed the same way, and the last found out a new passage through *Fretum de Mayre*, as we haue formerly mentioned. Whence we may easily deduce this Corollary, that the *Southerne continent*, not yet perfectly discouered, is either *One*, or (which is most probable) *many Ilands*: forasmuch as by sailing round about it, they haue found it everywhere compassed round with sea. The like may be conjectured of the other parts of the world; on

the northern side, wherof we shal speak in this next Theorem.

3. *It is probable that the Earth is compassed round with the water from North to South.*

I know nothing which hath exercised the witts and industrie of the Navigatours of our age, more then the finding out of a passage Northward to *Cathay*, and so to the *East-Indies*, which controversie as yet remaines altogether unanswered, and awaites the happinesse of some new discouery. In which difficult passage, wherein many haue spent both their liues and hopes, it may seeme enough for me to goe with their Relations; sufficing my conjecture to fye no farther then their sailes. The reasons which I meet with in my slender reading, I will examine as I can, without partiality, and so leaue every man to be his owne Judge. First then we must consider that the voyage to the *Indies* must be effected by either of these two waies; to wit, *Northward*, or *Southward*. To beginne with the South, it must be performed two waies; either by some vnowne passage through the *South-Continent* neare the *Antarlick Pole*, or neare the *Magellane-Straits*. The former is most vncertaine, for want of discoueries in those vknowne and remote parts: and if any such passage were found out, it were little advantage to our Countrey-men, who haue already a shorter and nearer way: yet no instance can be giuen to the contrary, but that this part being cloven (as it seemes most probable) into many lesser lands, may admit of such a passage: But in such vncertainties it is as easy to deny as to affirme. The second *South passage* is found out by Navigatours, which is either by the strait of *Magellan* it selfe, or else through the *Straights of Mayre* before-mentioned, which this Age of ours hath put out of doubt. The third passage is *South-east* by the *Cape of good hope*, knowne vnto our *East-Indian Merchants*, and therefore as a matter vnonequstioned, needs no further examination. The onely matter which troubles men in this Age, is the finding out of a passage *Northward to Cathay*, either by the *North-east*, or *North-west*; wherein we will consider two

things: 1 Whether it be likely, that any such passage should be at all? 2. whether this passage should be performed by the North-East, or North-West. For the former many arguments are vrged which seeme to crosse this opinion, of a way to the Indies toward the *North parts*: For 1. The manifold attempts of the *English* and *Hollanders*, both towards the *North East* and *North West*, either altogether spent in paine, or failing of their ends, seemes to give large testimonie, if not of absolute *impossibility*, yet at least of the *unlikelyhood* of any such discovery as is hoped, For what cost or dangers would not almost all the Marriners of our *Northerne world* vndergoe, to find so neare a cut to their *golden Indies*? and if by chance many of them mistooke the right way, yet would it seeme improbable, that later Nauigatours corrected by the former errours, should not after so many trialls and attempts, at length hit the mark. This reason sauours of some *probability*: yet comparing this with diverse matters of the same kinde, would seeme to be of no great force. For the truth and right being onely one and the same, is opposed by infinite errours: so that it may seeme easier to commit a thousand errours, then once to hit the truth: Time and long triall beget many Inuentions, which afterward seeme most easy: in somuch that many men haue afterward laught at their owne mistakes. Moreover, for ought I can find in the Relations of most mens discoueries, the passage which they sought was too farre *Northward* towards the *Pole*; where being infested with cold, Ice, and other inconveniences, they were enforced to returne thence againe, haing seldom had any opportunity to winter in those parts for want of *vituals*, or extremity of cold. A second reason against this *North passage* may bee drawne from the innumerable sorts of beasts wherewith *America* is stored: for admitting this passage, we must needs grant *America* to be an *Island*. Now it is certaine that *Noah's Arke* was the *store-house* and *Seminary*, not only of mankinde, but of all other perfect liuing Creatures. Againe, it is evident out of the *Holy Scriptures*, that the first

Regio

Region whereon the Arke was deliuiered of her burthen, was *Asia*. These grounds layed, I would demaund how such a multitude of beasts of al sorts, should be transported from *Asia* to *America*, being supposed to be an *Island*, and, and euerywhere diuided by the Sea from other parts of the Earth: could these silly creatures of their owne accord swimme from one shore to another? but alasse the Sea was too large, and these beasts too fearefull to adventure on such a voyage. And admit some by Nature had bin fittet to such an action, yet were it very strange to imagine the same effect of all, being of many kindes. What then? were they transported in ships? But *Navigatio* in those daies being an *Infant*, vnfurnished of the *Chart* and *Compaſſe*, durſt not a lventure into the *Ocean* ſo farre out of ſight of land. But to give the opposite part all reasonable advantage, admit the Straites diuiding *Asia* and *America* were very narrow, and within kenne; was it likely that from hence they could by ſhipps tranſport ſo many kindes of creatures? Could we beleue any man to be ſo mad, as to carry ouer with him *Lyons*, *Beares*, *Tigers*, *Foxes*, and other innumerable ſorts of rauenous and vnprofitable beasts, as pernicious to mankind, as other creatures ſeruing for his vſe? If any were ſound ſo foolish or malicious, yet were it very vnlikelie he ſhould tranſport ſo many kinds. This argument ſeemeſ no more to concerne *America*, then moſt Islands of the World, wherein we find diuers creatures, not only ſeruing for the vſe of man, but many vnprofitable & hatefull to the Inhabitants. The meaneſ of this tranſportation is very diſſicult to finde. *S. Augustine* with ſome other Diuines haue bin driven to a ſupernaturall cauſe, as if Almighty God ſhould perorme this matter by the miniftry of Angels, which anſwer we dare not utterly reiect, being ſupported by the authority of ſo great a Pillar of the Church: yet I cannot ſo eaſily imagine, that God who vſed naturall meaneſ for the preſeruation of all liuing creatures in the Arke, ſhould haue recourse to a ſupernaturall power in the propagation of theſe creatures on the face of the Earth: wherefore to me the reaſon would ſeeme better anſwered out of ouer ground, which we ſhall prove hereaſter:

That

That Islands were not from the first Creation, but afterward broken from the maine Continent by the violence of the Water: Hence it might come to passe, that such beasts as were in the parts of the Earth so broken off, haue since there continued by continual propagation vntill this day; I mean of ravenous and hurtfull beasts: because of the others lesse doubt can be made, but that they might be convoyed from one Country into another by shipping, to serue the necessity of mankind. Here we see that no argument as yet hath bin vrged so strong against the *North passage*, but may with reasonable probability be answered. It remaines in the secound place that we descend somewhat to particulars, to inquire whether this be to be effected either toward the *Northeast* or the *Northwest*: The *Northeast passage* hath heretofore bin attempted by many of our *English* Navigatours, but with vnhappy success: yet were not these voyages altogether fruitlesse; forasmuch as by this meanes, a way was found out to *Russia*, whence began the first trade betweene ours and the *Russian* Merchants: But that little hope can hence arise, sundry realons may be alleged, the chiefe whereof are these; 1. The dangerous tending of the *Scythick Cape*, set by *Ortelius* vnder 80 degrees Northward, together with the perillous sailing in those Northerne Seas alwayes pestered with Ice and Snow, seconded by diuerse *Bayes* or *shorlines*, *mists*, *fogges*, long and darksome *nights*, most adverse to any happy Navigation. 2. The obseruation of the Water, which is more shallow towards the *East*, which giues smal hope of a thorough passage, because all *Seas* are fed with waters, and for the most part are obserued to be more shallow towards the shore then in the midule: But where in sayling forward, any *Sea* is found to decrease in depth, it is a likely argument, that it is rather a *Creeke*, *Bay*, or *Riner*, then a *Straire*; Notwithstanding these reasons, some haue heretofore gone about to proue a passage by the *Northeast* to *Cathay*; of which opinion was *Antony Jenkinson*, whose reasons be well answered by *Sr Humphrey Gilbert*, which I will briefly touch, adding some things of mine own, as I find occasion. The first reaon was drawne

from

from a Relation of a *Tartarian*, who reported that in hunting the *Morse* he sailed very far towards the *South-east*, wherein he found no end; which might giue a likely conjecture, that it was a passage throughout. But to this we may easily answere, that the *Tartarians* are a barbarous Nation, altogether ignorant of Navigation, which neither know the vse of the *Charte*, *Compass*, or *Celestiall Observations*; and therfore in a wide Sea know not how to distinguish the *North-east* from the *South-east*: Besides, the curious search of this long passage must depend on better iſcourers then a poore Fisher-man, who ſeldome dares adventure himſelfe out of ſight of land; besides, the Fisherman iudging by ſight, could not ſee aboue a kenne at ſea, which will proue nothing in regard of ſo long a diſtance. The ſecond Reaſon urged by M^r *Tenkinſon*, was this; that there was an *Unicorne*'s horne found vpon the coaſt of *Tartaria*, which could not come (ſaith he) by any other meaneſ then with the tides in ſome ſtreigh: in the *North-east* in the frozen ſea, there being no *Unicorne* in all *Asia*, ſaing in *India* and *Cataia*. To this reaſon I may anſwer with S^r *Humphrey Gilbert* many waies; 1 Wee may well doubt whether the *Tartarians* know a true *Uunicornes* horne, or noſ 2 It is not credible, that it could be diuen ſo farre by the Tide, being of ſuch a Nature that it cannot ſwimme. 3 The Tides running to and fro, would haue diuen it as farre backe with the *Ebbe*, as it brought it forward with the *Floud*. 4 The Horne which was caſt on this coaſt, might be the Horne of an *Aſinus Indicus*, which hath but one Horne like an *Unicorne* in his fore-head, whereof there is great plenty in all the *North* parts, as in *Lappia*, *Norvegia*, *Finnmarke*, as *Zeigler* teſtifies in his *History of Scandia*. 5 Lastly, there is a fish which hath a Horne in his fore-head, caſled the *Sea Unicorne*, whereof *Martin Frobifer* found one on the coaſt of *Newfound-land*, and gaue it to *Queene Elizabeth*, which was ſaid to be put into her *Wardrobe*: But whether it be the ſame which is at this day to be ſeen at *Windsor Castle*, I cannot tell. The third and ſtrongeſt reaſon which was urged for the *North-east* paſſage was this: That there was a continuall current through the

Frozen Sea, of such swiftnesse, that if any thing were throwne into the water, it wold presently be carried out of sight. To this we may easily answer, that this strong current is not maintained by any Tide comming from another Sea, but by diuerse great Riuers falling into this streight. In like sort we find a strong current from *Maeotis Palus*, by *Pontus Euxinus*, *Sinus Bosporus*, and along all the coast of *Gracia* (as *Contarenus* and diuerse others affirme out of their own experiance) and yet the Sea lyeth not open to any other Sea, but is maintained by *Tanais* and diuerse other riuers: so in this North-east part may this current of water be maintained by the Riuers *Duina*, *Ob*, and many others which continually fall into it.

Hitherto haue we treated of other passages, either effected or attempted to *Cathay* and the *East Indies*. The last and most desired and sought iu our time, is that by the *North-west*. This way hath bin often attempted, as by *Cabot*, *Danis*, *Frobisher*, *Hudson*, *S^r Thomas Button* and others, but as yet not found out. Neither hath it more troubled the industry of *Marriners*, then the wit of *Schollers*, which we shall find by discourses written of that subiect. The absolute decision of this controversie we must leue to Time: onely such probabilities as I chance to meet with, I will faithfully set down, to give encouragement to their deseruing labors, who shall farther attempt the search and full discouery of this *North-west* passage. The Reasons I find vrged, I may well reduce to three Heads: The first is drawne from the testimonies and opinions of ancient Writers: The second from the Relations and discoueries of later Navigatours, from the time of *Henry*, the seventh, till our age: The third and last from the last and newest adventures of men of our time; either lately dead or liuing. To begin with the first, we shall from the testimony of *Plato* in *Tima*, as also in his Dialogue called *Critias*, draw a probable argument: for there he makes relation of an incomparable great Iland, named *Atlantis*, of larger extent then *Europe* and *Asia*, which was sittuate Westward from the streights of *Gibraltar*, and navigable round about. The Princes of this Iland

(according to *Plato's* report) heretofore extended their government ouer a great part of *Europe* and *Africa*. To second which opinion of *Plato*, we shall read in *Marinus Siculus* his *History of Spaine*, that in the *American* golden Mines, discouered by *Columbus*, there haue bin found certain pieces of Coine, ingrauen with the Name and Image of *Augustus Cesar*, which were afterward sent to the *Pope* by *John Rufus, Archbisshop of Consentium*: whence a probable conjecture seemes to be grounded, that *America* in those dayes was both populed and discouered. Now it appeares again not only by *Plato*, but also by the opinion of *Marcellus Ficinus, Crantor, Proclus, and Philo Indicus* is witnessed in their learned *Commentaries on Plato*, that this Iland called *Atlantis*, some 600 yeares before *Plato's* time, suffred an extraordinary inundation, & was swallowed vp by water: other like exâples whereof we shall produce many, hereafter in place convenient: admitting these testimonies of antiquity, whereof we ought to cherish a reverend esteem, these conjectaries will seeme to offer themselues by way of necessary consequence: 1 That this Iland *Atlantis* was the same which afterward from *Americus Vespuus* got the name *America*: because we find no Iland in the *Atlantick* Ocean which comes neare that greatness and quantity assignd by *Plato*: 2 That this *Atlantis* or *America*, in those dayes at least was an Iland, because they reported it to be Navigable round about. 3 It must stand with great reason & probability, that this land being an Iland before *Plato's* time, should be so still, if at least it come not neare to the nature of an Iland at this day, then before: For either this Relation of the overflowing of this land is true or false: If at all it deserues credit, more reason is, that it should be Navigable round about then before: in somuch that the Water in this manner swelling high, would sooner fret through and cause a passage, then make a stoppage. 4 This passage must of necessity be toward the *North-West* where *America* is divided from *Asia* by the streites of *Anian*, which opinion seemes better warranted, for asmuch as we find it seconded by the descriptions of many Geographers of great

name and authority, as *Gemma Frisius*, *Munster*, *Appian*, *Hunterus*, *Guicciardine*, *Michael Tramafinus*, *Franciscus Demongenitus*, *Bernardus Puteanus*, *Andreas Vavasor*, *Tramontanus*, *Peter Martyr*, and *Ortelius* in his generall Mappe: Who all haue described *America* as an exact *Illand*, setting downe all the coasts and countryes on the *North-West* sea of *America* from *Hoche-laga* as farre as *Cape Paremantia*; all these learned men hauing with one voice described or reported *America* for an *Illand*; He should shew but a slender esteeme of antiquity, or sauer of too much selfe-conceite, who should offer to contradict. This first Argument I confess spunne out into so many circumstances, seemes at first sight to carry a great shew of truth; but vpon sound examination will be found very defectiue, and vncertaine, carrying more probability in the conclusion, then the premisses dare to iustify: How many *Paralogisms* and vncertaine grounds are involved in this reason, let my ingenious reader iudge: 1: whether *Plato's* report of this *Atlantis* were a true Relation grounded on experience and observation, or a pleasant *Fiction* derived from the Poets of that time, wherwith the *Grecian Learning* was much infected; 2: How comes it to be thought probable that *Plato* in those dayes should be so exact in delineating out the bounies of this *New-world*, who was so ignorant in the old, as to thinke *Europe* and *Asia* to be inferiour in greatnessse to *America*, which notwithstanding he thought to be an *Illand*. 3: How should so famous a King as *Atlas*, stretching his Monarchie (as the Authors of this reason report) from *America* to a great part of *Europe*, and *Africk*, in that vast gulph of time, slippe away with so slight a mention: That there was such a Prince as *Atlas*, I make no question; vpon whose fame and greatnessse the Poets grounded that fiction of raising vp the vault of heauen with his shoulders: But whether this *Atlas* ever saw *America*, my reader must give me leue to make a doubt; The Ignorance of Nauigation in those times, wherein occasion had not brought to light the chart & compasse, together with the huge vastnesse of the *Atlantick Ocean*, will speake my Apologie. 4: The finding of coine grained

with

with the Image and inscription of *Augustus Casar* in the American mines, seemes to me more ridiculous then all the rest: We find the acts and conquests of *Cesar* and *Pompey* in Europe and *Asia* and some parts of *Africk* particularly set downe by the graue writers of that time: We find *Augustus Casar*, for some pety cōquests against barbarous people, emblazoned by the Poets of that time to the highest pitch of their invention: we may obserue the age wherein *Augustus* lived to be the florish and pride of all the *Romane* learning: and himselfe the Idol and subiect of most of their poetical flatteries; having the happinesse to be invested in the empire, in such a time wherein the *Roman* Monarchie hauing bin too much wounded with a ciuill dissention, was willing to admire her worst Physician: And can any man be so sensesse to imagine that the discouery of the golde world should passe away clouded in such a flattering age, without any mention? could not so much as the name be registred to teach posterity the way to so rich an Empite? For my owne part I can ascribe this, (if the *Hystorie* deserue credit) to nothing else but the pride and imposture of the *Spaniards*, whom we obserue in all relations to be a most ingratefull Nation, who admiring nothing but their owne greatnessse, haue requited their best deserving benefactors with disgrace, and obloquie; striuинг to raze out their names and memory to whom they owe the greatest glorie. *Columbus* was a *Florentine* and no *Spaniard*, and therefore must not deserue so much of *Spaine* as his golden *Indyes*: otherwise *Augustus Casars* image had bin better lost then found; and the Bishop receiuied small thankes for his *Parastick* presentation. 5: That *America* should euer suffer such a deluge as to be lost for so large a time, will sooner be admitted as a pleasant discourse in table talke, then purchase credit as a likely *Hystory*: it seemeth to be doubted by *Mer-
cator* a Great Geographer of latter times, inferiour to none before named, whether euer this tract of land were overwhelmed with Waters in the generall deluge; which he was inden-
ced to beleue out of the disparity of the *Soile*, *Herbes*, *Feasts*,
and *Inhabitants* with ours in *Europa* and other parts of the
world;

world; This opinion I hold not sound in Divinity; yet stremes it backt with more strength of humane reason, then *Plato's* fable of this imaginary *Atlantick Iland*: Much more could I speake of the vncertainty of this first argument, were I not afraid to tire my Reader too much: But this *Northwest-passage* is a long voyage, and hath bin for a long time sought, and therefore I hope ingenious men will pardon my long discourse.

2 The second reason is taken from a Relation reported by *Gemma Frisius* of three Brothers, who in ancient time passed through this straite into *America*: which accident gaue it the name of *Fretum Trium Fratrum*, by which appellation it is knowne at this day. This argument I take to be more weake then the other, as depending on vncertaine report, indebted I know not to what approved *History*: But where *History* is vncertaine, reasonable conjecture must challenge precedency: I will heare by way of doubt alse these few questions; whether these three Brothers before mentioned passed through this straite or not? If not, no good Argument can hence be grounded of such a passage: or if they passed through, I demand whether they returned to their Country or not, to make a relation? If they returned not, how could such a report with probability be brought home vnto vs? 3 If they returned home, how could such a memorable Action be forgotten, and not committed to any certain *History*? especially in such a *Monkish age*, wherein out of ignorance and want of experience, the most petty Inventions were admired for great matters: The reason as yet makes me to suspend my judgment of Decision, till I find better.

3 The third reason drawne from antiquity, best vrged and husbanded by *S: Humphrey Gilbert* for this *North west passage*, depends on a certaine Relation of *Indians* in ancient time, cast by tempest on the coasts of *Germany*. *Pliny* relates out of a report of *Cornelius Nepos*, who wrote 57 years before *CHARIS*, that certaine *Indians* were inforced by violence of tempest vpon the *Germane* coasts, which were afterward presented by the King of *Suevia*, to *Quintus Metellus Celer*,

Celer, then Proconsul of France, whereupon *Pliny* inserres in his 2^d Booke, 65 Chapter, that it is no great wonder, though there be a sea *North*, where there is so much moisture. To confirme this opinion of *Pliny*, and report of *Cornelius Nepos*, they produce the testimony of the excellent Geographer *Dominicus Marinus Niger*, who sheweth how many wayes the Indian Sea extendeth it selfe, reciting the same report of certaine *Indians* that were carried by tempest through the *North-seas* from *India*, vpon the Borders of *Germany*, as they were following their Trade of Merchandize: The argument grounded vpon these Testimonies will stand thus: These for:-named *Indians* arriuing on the coasts of *Germany*, must come of necessity either by the *South-east*, *South-west*; *North-east*, or *North-west*: The three other coasts seeme altogether improbable, and therefore this opinion of the *North-west* seemes more worthy credit; first, they came not by the *South-east*; because the roughnesse of the Seas, occasioned by stormie windes, and strange currents in those places about *Cape bona Speranza*, seconded by the sinallesse of their *Canoas*, wherein the *Indians* vially travailed, seeme to stand against such a long voyage: 2 They could not well come along by the shore of *Africk*, and so passe into *Europe*, because the windes doe there commonly blow *Easterly* off from the shore; so that the current driving that way would sooner haue carried them *Westly* vpon some part of *America*, where they should by all likely coniecture, haue perished in that great *Atlantick* Sea, either in that huge and great *Atlanckie* Sea either by *shipwracke*, or want of *provision* in so small a vessel. 3 If they had overcome all these dangers which wise men would hardly take vp vpon trust: It seemes hard they should not haue first touched vpon the coasts of the *Azores*, *Portugall*, *Spaine*, *England*, or *Ireland*, before they should arriu at the coasts of *Germany*. 4 For the reason before-named they could not come from the *South-west*, because the current which commeth from the *East*, striketh with such violence on the straites of *Magellane*, runting with such swiftnesse into the *South-sea*, or *Mare del Sur*, that a shipp without great burden cannot

cannot without much difficulty arriue at our *Westerne Ocean* through that narrow sea: What then shall we imagine of an *Indian Canoa* managed by such vnskilfull marriners? 5. To proue these men to be true *Indians*, and neither *Africans* nor *Americans*, seemes to be warranted; because the Inhabitants of *Afrika* & *America* neither had, nor scarce know other knde of Boates then such as beare neither *maates*, nor *sailers*; but such as are only carried along by the Shores: except of latter times such as haue bin instructed by the *Turkes* on the coasts of *Barbarie*, or by the *Spaniards* in *America*: This argument I confess is wittily spunne out by my renowned country-man *Sr. Humfry Gilbert*, whose ability seemes to haue made a haruest out of the stubble. Neuerthelesse in my conceipt it promiseth in the conclusion more then the premises can well warrant: For first it seemes not to me a matter so cleare out of question whether these ship-wrackt people cast in vpon the coasts of *Germany* were true *Indians*, for not; because so farre as my conjecture leadeth me, being grounded on *Historie*, the name of *Indians* out of the ignorance of those times hath bin giuen by the *Romans* to many other forraigne Nations farr distant; especially to the *Ethiopians* in *Africk*, which beside the testimony of diverse ancient Historians, too tedious to relate, may seeme probable out of that end of a verse of *Horace*; *Ultra Garamantas & Indos*: where for ioyning together two Nations so seperat in place, the former being in *Africk* the other almost in the farthest verge of *Asia*, he seemed as ignorant of the distance, as the people. 2 How shold these *Westerne* inhabitants know these men to be true *Indians*, whose *condition*, *place* and *language* they neuer vnderstood? 3 Why might not these men come from some of the *Illands* in the *Atlantick Ocean*? 4 The reason against it, drawn from the current striking with such force on the *streights of Magellane*, is contradicted by the experience of latter Nauigators: much more I could speake of this reason; but that I hold it better to cherish a hope of such a passage, then by excepting against these ancient arguments to discourage moderne industrie.

Other probabilities may seeme to be drawne from the discoveries

coveries of later Nauigatours since the raigne of *Henry the seventh*, vnder whose protection *Sebastian Cabot* vndertook the discoverie of the *North-West* coasts: In which he prevailed as much as the *Alchymistes*, who in seeking out the *Philosopher's stone* haue often mist of their aime: yet by this meanes inuented many rare and excellent secrets, of vse, and admiration. That *Cabot* the same yeare discovered as much of the *Northerne parts of America* as *Columbus* of the *Southerne*, cut of my small reading seemes to me no great quæſtion, whence I cannot imagine that King *Philip of Spain* can in this *Newfound world* challenge a greater interest then King *Charles of great Brittain*: a *Prince* of those incomparable virtues, which may be thought worthier to own, then the other's to pretend to so great a Soueraignty: For the latter voyages & discoueries of *Davis* and *Frobisher* (for ought i ſee) promise scarce ſo much as *Hope*, which oftentimes flatters and deceiuers men with her best countenance. But if we take vp wares vpon trust, ſome will tell vs of a *Portugall*, who made a voyage through this *Streite Northward*, calling a *Promontory* within the ſame after his name *Promontorium Corterialis*; of *Scolmisa a Dane*, who paſſed a great part thereof: but the moſt probable in my coniecture, is that which *S^r Humphrey Gilbert* reports of one *Saluaterra* a Gentleman of *Victoria in Spaine*, who was ſaid to haue paſſed by chance out of the *West Indies* into *Ireland*, in the yeare of our Lord 1568, who conſtantly averred the *North-west* paſſage from vs to *Cathay* to be thought navigable; and farther related in the preſence of *S^r Henry Sidney*, then Lord Deputy of *Ireland* (*S^r Humphrey Gilbert* being then preſent) that a Frier of *Mexico* called *Andrew Vrdanetta*, more then eight yeares before his arriuall, told him that they came from *Mare Del Zur*, through this *Northwest* ſtraite into *Germany*, and ſhewed *Salvaterra* (being with him at that time in *Mexico*) a *Sea-chart*, made out of his owne obſeruation in that voyage, wherein ſuch a paſſage was ex- preffed, agreeing with *Ortelius* his *Mappe*: moreouer this Frier told the King of *Portugall* in his returne by that country home-ward, that hauing found ſuch a *Northwest* paſſage, he

meant shortly to make the same publicke; but the King earnestly intreated him not to discouer this secret to any Nation; for that (said he) if England had knowledge and experience of it, it would greatly hinder the King of Spaine and me. This relation I could willingly credit from the mouth of any other man then a Frier; of whose palpable lyes, and fabulous inventions in their flattering letters to the *Pope*, from both the *Indies*, we haue sufficient experience. Neuerthelesse that future ages might not despaine of so worthy an attempt as the discouery of this passage, it hath pleased God to stirre vp the Spirits and Industry of two later Nauigatours, *Hudson*, and *St. Thomas Button*, who haue reviued the forlorne hopes of the former. For the particulars of whose discoveries I know not better where to referre my Reader, then to a curious Mappe not long since set out by our worthy and learned Professor *M^r Briggs*: the arguments I collect from thence are these, expressed in his own words; 1 In the bottome of *Hudson's Bay*, where he wintered, the hight of the Tide was but two foot, whereas by the nearenesse of the South sea in *Port Nelson*, it was constantly 15 foot or more. 2 Moreover in *Port Nelson*, where *St. Thomas Button* did winter, in 57 degrees he found the Tide constantly, every twelve hours, to rise 15 foot or more: and that a West wind made the *Nepe Tides* equal with the *Spring Tides*; and the Summer following, about the latitude of 60 degrees he found a strong race of a Tide running sometimes Eastward, sometimes Westward. 3 To shew the land toward the *South sea*, through which we seeke to open this passage, not to be so far off as our ordinary Charts seeme to pretend, may be probably auerred, in that *California* heretofore supposed to be a part of the *Westerne Continent*, is since by a *Spanish* Chart taken by the *Hollanders*, found to be a great *land*; the length of the West shore being about 500 leagues from *Cape Mendocin* to the South Cape thereof, called *Cape St. Lucas*; which may appeare both by the *Spanish* Charts, and by the report of *Francis Gaul*, whereas in the ordinary Charts it is expressed to be 1700 leagues. These Arguments, I confess, haue swayde my opinion, but not as yet ab-

solutely freed me from doubt. Three *Quaries* I must leue for the learned to consider, and for the time to decide; 1 whether this relation of Mariners concerning the Bay of S^r *Thomas Button* and *Hudson* be true or no? no man will (I suppose) censure me as vnmanerly for asking such a question, considering how much many Navigatours, either by their mistakes or their industrious falsities haue deceiued mens credulities; the one is incident to mankind, which out of vncertain obser-vations, or vnecessary deductions, from thence often drawes an ill consequence; The other, the ordinary policy of discou-*re*rs, who left their Trauailles might bee thought fruitlesse, would at least promise hope in the reverstion. How many relations haue bin corrected by experiance of later Navigatours, euery one may judge. 2 Whether this strong Tide in *Hudsons Bay* comming from the *West*, were from the *South-Sea*, or from the *North*, betwixt the Continent and diuerse Islands by an *Inlet*, is not a matter as yet clearly out of doubt. *Terra Del Fuogo* was heretofore supposed to be a *Continent*, till *Schouten* in his discouery found it to be an *Island*, and a large Sea beyond it toward the *South*. Likewise *New-found-land* in all our former Mappes and Globes, expressed as a part of the Maine of *America*, is by later experiance found to be an *Island*: and why may not this happen in the other, that at the entrance into *Hudsons Bay*, the land on the right hand should be clouen into many *Islands*; betwixt which the waters issuing, should be turned in such sort, as it might seeme to proceede from the *West*: sith the Tides taking their beginning from the *Maine Sea*, and continued through some Straite, commonly followe the crooked windings of the Channell. 3 That *California* is an *Island*, it may (for ought I know) be well warranted: But the euidence drawne from the *Spanish Chart*, seemes rather to cherish hope, then perswade consent. In this which I haue spoken of these worthy mens coniectures, I haue rather expressed my doubts, then my opinion; esteeming notwithstanding that *doubt* almost an *Heresie*, which should discou-*rage* any generous and deteruine spirit from a farther attempt of this *North-west Passage*.

C H A P. VIII.

Of Sea-Trafficke and Merchandise.

1 F the Internall Affections of the Sea we haue spoken: It remaines now that we treate of the Externall: By the Externall I understand that which belongs to Sea-Trafficke, or Navigation.

2 Sea-Trafficke is a passage by Sea from one Countrey to another.

It is not my purpose in this place exactly to set downe the Art of Navigation, being a matter requiring a speciall Treatise of it selfe: yet because shipping and Navigation, as Externall or adiacent Accidents, belong to the Sea as the proper subiect; I could not altogether slip them ouer without some mention: In handling of which matter I onely propose to my selfe two things: first, the Author and efficient causes of *Sea-voyages* or Navigation; Secondly, the End and *Vses* thereof; both which we will knit vp in these two generall Theoremes.

1 Navigation first taught by Almighty God, was afterward seconded by the industry of famous Men in all ages.

The first invention of this excellent art we can ascribe to no other author then God himself, who first taught the Hebrews his chosen people, and not the *Egyptians* and *Phenicians*, as some haue falsly imagined: For we read in *Genesis* that Noah

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according to God's precept, made an *Arke* for the preservation of himselfe and other living creatures from the deluge: before which we cannot learne that there was extant any skill of *Navigation*: Of which we haue many reasons and conjectures giuen by ancient writers. 1 Beccatius in those times there was greater need of *Citties* then *shippes*; because citties are not made for shippes, but rather shipp for the vse of citties. 2 Small or little commodity could in those times be reaped from other countries, lying as yet rude and vnpolished without Inhabitants. 3 Some would haue this to be a reason why God revealed not this art to the *old worldlings*: because being ready to perish in the flood, no man might haue meanes to escape or saue himselfe, which without doubt they would haue attempted, had the art of Navigation bin known amongst them. Whence it is a probable conjecture, that this knowledge of Navigation was discouered first to *Noah* at the time of the *Deluge*: whose *Arke* resting afterwards on the mountaines of *Ararat*, gaue a presidenc to other Nations neere bordering, in what manner shippes were to be framed. Whence it came to passe that the first to whom this skill was derived next to the *Hebreues* were the *Tyrians* and *Phenicians*, Nations as well for the commodity of the place as Inclination to such busynesse more accommodated to Navigation: For *Tyre* was a chiefe *Mart-towne* of *Phenicia* bordering vpon the sea. Which knowledge being derived from them to other nations gaue occasion to *Stratus* and *Strabo* to conjecture that they were the first Inventours of it, being not able through the want of holy writ to ascend higher. From the *Phenicians* was this knowledg derived to the *Egyptians*, as *Pliny* reports in his 7 booke and 56 chapter, when as yet this art was but rude and altogether vnpolished, as may appeare by the same *Pliny*; who testifies that they then began to saile in a certaine vessel called *Ratis*: which word howsoeuer it now be taken generally for any ship, was originally interpreted to be made of *Beames* ioyned together; In which kind of ship they are reported to haue passed the *Mediterranean sea*, but especially the *Red-sea*, being set out by

King Erithra. Then came this art from the *Egyptians* to the *Gracians* (according to *Pliny* by *Danaus*) who perfected this science, and made a ship in a more exact forme then he had learned amongst the *Phenicians*: whence *Danaus* was celebrated the first Author of this inuention: it being a common error amongst all Natiōs to ascribe the first inuention to him, who was the first discoverer of it to them, being able to deriu it no further: Yet the *Gracians* being very full of fabulous inuentions haue found out other Authors of this art; for *Strabo* in his 10 booke, giues it to *Minos*: others, as *Diodorus Siculus* in his 6 booke, to *Neptune*; who is of opinion, that for this cause he was afterward translated into the number of the Gods. But this is certain that amogst all the *Gracians* the *Cretensians* were the first that excelled in this faculty. Whence grew that Proverb: *Cretensis nescit Palagus*: as who should say nothing could be imagined more absurd and ridiculous then that a man should be borne in *Creet* and haue no skill in Nauigation: Others ascribe the first knowledge of making ships to *Dedalus*, a rare workman in mechanical occupations: From the *Gracians* afterwards was this trade communicated to the *Italians*, amogst whom the *Genevensians* and *Venetians* most excelled. Of the *Venetians* skill in this matter, we read no other argument then their great riches and magnificent power, especially by the sea, which hath continued vnto this day: whereof no other cause can be thought on, next vnto Gods prouidence, then their industrie in *Sea-voyages*. After these arose the *Portugalls* who vnder the conduct and direction of *Columbus* an *Italian*, discovered *America* called the new-world, and gaue example and excitement to many other Nations to adventure farther. Amongst which (by the testimony of out-landissh people) no Nation hath waded farther then the *English*, who vnder *Drake* and *Candish* haue compassed about the world and left an eternall Trophie of their immortall fame vnto posterity. Yet can we not heere defraud the *Low-country* men of their due commendation, especially the *Hollanders*, *Flemings*, and *Selanders*; who by their riches acquired by nauigation and extraordinary power at Sea, haue kept in despight of the

the usurping Spaniard these Provinces, farre richer then at the beginning of their warres, and deserued that saying which was giuen to one of the Gracian cities, by the Oracle; That it was guarded not with stones, but with wooden walles. Thus much may suffice for the Authors and first Inventours of Navigation. We are now to speake something of the ends & uses of it, which may in generall be referred either to profit or pleasure: Both which are againe spread into many Branches; the most of which we shall comprie in this following Theorem.

2 Navigation is very necessary as well for the encrease of Knowledge as Riches.

Necessity is vsually taken two wayes; either for an absolute need, without the which a thing cannot be: or Comparatively for a conveniency, without the which a thing cannot well be: In both senses I may call Navigation necessary for a mans life: for to deferre the later, whereof lesse doubt is made; it is certaine that many places are so poore, barren, and indigent of all succour and relief, that they cannot maintaine a populous Nation without forraigne commerce and traffick; especially in these dayes, where the multitude of men is increased to so great abundance: for the later, many arguments may be produced to proue the conveniency of Navigation, which no man of any iudicious insight can deny to be most strong and forcible. The first argument may be drawne from the Authors and Inventours of it, whereof we haue spoken in the former proposition: for first (as wee haue shewed) it was prescribed by God himselfe, who never taught mankind any thing idle or vnnecessary. It was embrased and cherisched by many Nations euuen till this day, which no doubt had long since bin lost; had not vse and profit seconde the Invention. Neither is it probable that Almighty God should create that vaste Masse of Water, that it should be an Element for fishes to liue onely, or that (as some guesse) it should somewhat mitigate the extremity and drouth of the Sunnes heat: But that men should by this meanes haue an ea-

sie and ready way to communicate and traffique one with the other ; which may appeare aswell by many *Testimonies* out of the sacred *Scripture*, namely *Psal. 104 ver. 25. Esa. 26. ver. 1. 2.* as also by the example of King *Salomon*, the wilest of all Kings, who by this meanes got great store of gold from *Ophir* to build the Temple, as will appeare in *1 Kings* and the *9 Chapter*. The second reason therefore may be drawne from the exercise of *Merchandize*, and transportation of commodities, which cannot be administred without *Sea-voyages*: first because greater store of *Merchandize* may be carried in a *ship* then in a *Cart, Waggon*, or any other Instrument ordinarily in use. Secondly, because in ships greater variety of wares may be brought from diuerse places, to which a *Waggon* cannot without great difficulty approach, or not at all. Thirdly, because wares and such commodities cannot so quickly bee convoyed in the land from places farre distant, as on the sea: nor with so little cost and charges. The commodities convoyed from one country to another are chiefly three; *stuffs* and other matters necessary for apparel: *victuals* and *food*; *Physicall Druggs*: all which no man will deny to be most profitable for the use of mankind. Moreover it is not to be imagined that nature produceth such commodities only for the priuat behoof of some one country wherein they grow: First because such commodities in some countries are found in such abundance, that the same place seemes not to need them: And nature were vaine, if the use were not required. *India mittit Ebur, molles suathura Saba*. Secondly, because other Nations altogether want such things which abound in other countries: without the which notwithstanding they cannot well live. A fourth reason may be drawne from the promotion of *Religion & sciences*, which cannot well be atchieved without *Sea-voyages* or *Navigation*. For the former we need goe no farther then the holy *Scripture* which giues large testimony of such voyages: In the old *Testament* aswell as in the new, we haue recommended to all posterity the industrie of the Queen of *Saba*, who is said to haue come from the vttermost parts of the Earth to heare the wisdom of *Solomon*: And how should

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the Gospel of C H R I S T haue bin divulged to diuerse Nati-
ons, had not the Apostles dispersed themselues, and passed the
Sea in ships, to convay their sacred message to diuerse Nati-
ons and Kingdomes? neither is it lesse evident in the propaga-
tion of Learning and humane Sciences: First, out of the exam-
ple of many & famous worthy Philosophers, who trauailed far
to conuerse with learned men of other Nations, to enrich their
mindes with knowledge. Secondly, out of the first propaga-
tion of Learning into our parts; which we shall finde (as it
were) foot by foot to follow Navigation. Hence we see that
from the *Hebreues* and *Chaldees* it was deriued to the *Tyri-
ans*; from them to the *Ægyptians*; so to the *Romanes*, and
thence to most parts of *Europe*. A fourth reason may be taken
from the necessity of transporting Colonies into forraign coun-
tryes: for as after the vniuersal *Deluge* of the world, the people
dayly encreasing, were enforced in tract of time to disperse
themselues into diuerse Countryes: so euery Country left to
it selfe, and not much molested with famine, or devoured by
warres, will at length grow too populous, vnable to sustaine
it's owne weight, and relieue it's own Inhabitants. Whence
it hath bin a policy practised by most Kings & States in such
cases, to make forraigne expeditions, and send forth Colonies
into other Countryes lesse peopled, to disburden their owne
of such encombrances: as we see the Kings of *Spaine* to haue
sent many into the *West Indies*; and we at this day discharge
many *Idlers* into *Virginia* and the *Barmudas*. Here also is the
Art of Navigation vsefull, without which, the Seas could
not be passed, nor forraigne Countryes knowne. Fiftly, Navi-
gation seemes to be of greater importance for the defence of
a Country against forraigne Nations; because *Sea-fights* are
lesse dangerous and inconvenient to the Land, then *Land-
fights*. All these arguments haue their force and life to proue
the profit of this excellent Science. Many arguments may be
drawne to proue the vse of it for pleasure and delectation;
which being well vsed, hath his place amongst other of God's
especiall blessings. This delight will first shew it selfe in the
mutuall commerce and society with other Nations: Sith a

man (as Aristotle affirmes) is by nature inclined to mutuall society, and cannot reape greater pleasure then in such coniunctions: And as one Man with another findes solace; so one Nation with another: especially in the varietie of sundry *manners, customes, rites, and dispositions.* Secondly, in the contemplation of wise *Nature*, who hath endowed diuers countries with diuers *Minerals, Plants, Beasts*, and such commodities; then which variety nothing can be more delectable to an ingenious vnderstanding. To all which we may add as a *Corollary*, the *Honour* which hath bin giuen to Navigation by Princes and States, aswell of former as later yeares. In ancient times we read that *Ptolemy Philadelphus*, that learned King of *Ægypt*, who furnished himselfe with so rich a *Library* 277 yeares before *CHRIST's Incarnation*, gaue great incou-ragement to Navigation, and maintained the passage through *Sinus Arabicus*, or the *Red Sea*, by which the commodities of *India* and *Arabia* were brought to *Alexandria*, and from thence dispersed through diuerse places of *Europe, Asia, and Africa*. This was afterward seconded and cherished by the *Romans*, at what time *Ægypt* was made subiect to their dominion: But the *Roman Empire* being afterwards rent in pieces by the *Gothes, Vandals, Lumbards, and Saracens*, all traffick betwixt nations began a while to cease; till such time as the inconvenience being knowne, a new *Mart* was set vp at *Capha in Taurica Chersonesus*, belonging at that time to the *Genois*: Thence was it deriu'd to *Trebizond*, and afterwards to *Samerchand*, where the *Indian, Turkish, and Persian Merchants* were wont to trade with the *Venetians*. This *Art* was afterwards set vp and revived by the *Sultans of Ægypt*, through the passage of the *Red Sea*, till such time as it was in a manner taken away by the *Portugals, Spaniards, English, and Dutch*; who haue found out for themselues a better way by the *Cape of good Hopes*, to the *East Indies*, and by this meanes much abated the Traffick of *Alexandria*, and the wealth of the *Venetians*. Neither in this *Age* of ours haue there wanted great *Potentates*, who haue not only endowed this *Trade* with great and ample priuiledges; but also themselues practised such

such commerce, aswell for the benefit of their Commonwealth, as the increase of their particular estate. Two memorable examples we haue in *Henry the Th:rd, King of England*, and *Laurence de Medices Duke of Florence*, whereof the former gaue many and large priuiledges to all the *Harcie Towns* in his kingdomes, which were in Number about 27: The other himselfe for his owne priuate commodity exercised the Trade of Merchandise: yet was this man most ingenious, and a great lover of learned Men.

C H A P. IX.

Of Pedography, Riuers, Lakes, and Fountains in the Earth.

- 1  Ee haue formerly treated of Hydrography, or the description of the Water, now are we (by Gods assistance) to proceed on to Pedographie, which is a description of the Firme Earth, or Dry-land.
- 2 The Land is a space contained in the superficies of Earth, distinguished from the Water.

The Earth in this place is not taken as in the former part of Geographie for the whole *Terrestriall Sphære*, composed of Earth & Water: Neither yet as it is vsually taken in *Natural Philosophie* for an Absolute Elementary body, whose causes & affections are to be searched out; but Topographically for a place or habitable space on the dry-land; This dry-land distinguished

guished from the Water by it's Firmnesse and Constancy, being not subiect as the Water to motion and inconstancy, was therefore (if we belieue the Poët) called *Vesta*; according to that verse, *Stat vi terra sua, vi stando Vesta vocatur*. Neither wants this table of *Vesta* a sufficient morall. First, because *Vesta* was faigned to be a keeper and protectour of their houses, which may very well agree to the Earth: which not only sustaines and beares vp all buildings and houses; but also affords all commodities and fruits wherewith houſholds are maintained. Secondly, *Vesta* was fained to be the Goddess to whom the first fruits were offered in sacrifice: which may wel square with the nature of the Earth, from which all fruits are originally deriued; and therefore (as it were of due) ought all first fruits to be consecrated to her altar. Two other Parallels betwixt the Goddess *Vesta* are added by *Natalis Comes*: First, because *Plutarch* sheweth in his *Sympoſiacks*, that the Tables of the Ancients, dedicated to *Vesta*, were made round in forme and fashion of the Earth: Secondly, because the seat of *Vesta* was imagined to be in the liquide Aire immoueable, and not subiect to motion: which well agrees with the common conceiued opinion of the Earth. But these two rather expresse the nature of the whole Terrestriall Spheare, then of the land diuided from the Waters: This description of the dry-land separated from the Waters, we haue termed *Pedographie*: because the Greeke *πεδον*, commonly deriued from *πες*, a feote, signifieth as much as a firme place, whereon men may haue sure footing, to which is consonant the Hebrew word *תָּרוּת*, which seemes most probably deriued from *תָּרוּ*, which signifieth as much as *Terere*, to weare out or waste: because the Earth is daylie troden and worne with our feet. The proprieties of the Earth appertaining to a *Cosmographer*, are many and various; wherefore to auoide confusio[n], we haue diuided them into these heads.

3. The Adiuncts of a Place in the Land are either *Naturall* or *Ciuill*: The *Naturall* are such

such as are inbred in the Earth.

4. The Naturall may be againe diuided into *Perpetuall*, or *Casuall*. *Perpetuall* are such as alwayes, or most ordinarily continuall the same.
5. The *Perpetuall* proprieties are again two-fold; either *Absolute*, or *Comparatiue*. The *Absolute* I call such as agree to the Land without any respect to the Sea.
6. Of the former sort are such as belong to the Figurature of the Soile; wherein three things are most remarkable: 1. *Riuers*, *Fountaines*, and *Lakes*. 2. *Mountaines*, *Valleyes*, and *Plaines*. 3. *Woods*, and *Champian Countries*.
7. A *Riuer* is a perpetuall course of water from a certaine head or fountain running from an higher to a lower place on the earth.

Rivers are by some Geographers more curiously distinguished into 2 sorts: whereof the first are settled or stayed Rivers, which slide away with a more equal and uniforme course: The latter are called *Torrents* or stickle waters, which are carried with a farre greater violence. In a Riuer three things are chiefly remarkable: First the *Fountaines* or *Springs*: secondly *Whirle-pooles*: Thirdly the *Mouth* of it. The *Spring* is the place, where at first the water sensibly breakes out of the

Earth: As *Nilus* in *Africk* is thought to haue his first head at the mountaines of the *Moone*. A *Whirle-poole* is a place in a Riuier, where the Water falling into a Deepe trench, is whirled and turned round: The *Mouth* is the place where any Riuier finds a passage out, either into the sea, or into another greater Riuier; which in latin is tearemed *ostium* or a gate: Whence they call *Septem ostia Nili*: which are seven mouthes, by which it falls into the *Mediterranean*. This gaue the name to many Cities and Towns in *England* as *Plimmouth*, *Dartmouth*, *Portsmouth*, *Axmouth*, with many others. Now for asmuch as all water is by nature heauy, and therefore covets the lowest place; The course of all Rivers must needs be from a higher to a lower place: whence we may guesse the hight of lands. For it is necessary that for euery mile wherein the water glides forward on the earth, there be made an allowance of 2 foote at least in the declivity of the ground. For although water will slide away at any inæquality, yet could not the water be wholsome, and retaine any reaionable swiftnes of motion without this allowance. Hence we may probably find out the huge hight of the alpes about all the paces in *Europe*: because out of them spring foure great Rivers, which runne foure waies; whereof the two greatest are the *Danow* (which receives into it 60 Nauigable rivers and so disburthenes it selfe into the *Euxine Sea* far remote) and the *Rhene*. Of Lakes and Rivers many memorable matters may be spoken: all which we will reduce to these heads. 1 Their *Generation* and first originall: 2 Their *Appearance*: 3 Their *Place* in the earth: 4 Their *Vertues* and effects; all which we will comprehend in these Theoremes following.

1 All Rivers haue their first originall from the sea the mother of Rivers.

The originall of fountaines and Rivers on the earth is a matter of great difficulty, and for ought I know, not yet found out of our greatest Philosophers; yet being willing to goe as farre as I can, I will glaunce at probabilities, and first let downe other mens opinions. Some haue bin of opinion
that

that in the bowells of the earth are hid certaine vast concavities and caverns, which receiving into them a great quantity of raine-Water, haue giuen originall to *Lakes* and *Fountaines*. Hence they giue the reason why these fountaines are perpetuall; Beacauile the raine-water received into these caverns being extraordinary great, is sufficient to nourish such springs of water vntill the next winter; whence comes a new supply of more raine. These Riuers (say they) in the summer decrease, and sometime are dry, because of the defect of water, when the place is not great enough to receiue sufficient water for the whole yeare. This opinion seemeth grounded on these reasons: First because we find by experiance, that Riuers and fountaines are greater and larger in *Summer* then in *Winter*. Secondly because where there is lesse *Raine*, fewer or no Riuers are seene: As in the Desarts of *Ethiopia* and *Africk* few or no Rivers are found: But in *Germany*, *France*, *Bri. tany*, and *Italy* many Riuers shew themselves; because they abound in the moisture of the *Aire* and much fall of *Raine*. Thirdly amongst vs (we see by experiance) in a hott and dry *Summer* they are much decreased from their ordinary greatnessse, or altogether dried vp; which is a great probability that their originall is from raine. This opinion if it be only vnderstood of some Rivers, may be probable; because some currents out of doubt take their originall from great showers or snowes, as at the foot of the *Alpes* and other such places, where the snow dayly melts and feeds them: but if it be generally vnderstood of all Rivers, it is manifestly false as may appeare by these reasons. First, because the Earth no where drinke vp the raine farther then ten foot deepe in the soile; for the higher superficies of the earth is either dry and so easily drinke vp and & consums the Water within that space; or else being already moist, it receiues it not at all, but expells it by Rivers and channels: Secondly, some mountaines not couered with earth, but consisting of hard rock, notwithstanding send forth great store of *springs* and *fountaines*, which water could not be received in, through a hard rocky substance. Thirdly, because in very dry places certaine pits being digg'd downe in-

to the ground 2 hundred or three hundred foot deepe, will discouer many great stremes of Water, which could not be from the receite of Raine. Fourthly, it cannot be imagined that so much raine could in a winter fall into one place, besides that which the drouth of the earth consumes, to nourish so mighty and great Rivers in the Earth, as are Rivers running in a perpetuall course. Fiftly, all Rivers almost take their originall from some mountaines or other; as *Danubius* from the *Alpes*, and *Nilus* from the mountaines of the *Moone* in *Africke*; Which places being extraordinary high, are more vnapte to receiue water, then lower places of the earth. To the reasons that they alleadge for their opinions, it is not hard to answere: That riuers should be greater in the winter then in the summer, the cause may be better giuen; Because more moisture of the Aire falls into the brinke from external Raine or snow in winter then in summer; & the groûd being moister, is able to drink lesse then at other times: which is also the reason why in hotter and dry Countries there is not such plenty of Rivers: for we deny not, but fountaines may sometimes be increased and sometimes diminished by addition of raine water: but that any such vast concavity should be vnder ground, as the receptacle of so much raine, and should nourish so many and so great currents. The second opinion is of those who thinke that the originall of all rivers and fountaines is from the sea: Which conceit hath bin strongly fortified by many Fathers of the Church, and graue Divines of later time; which opinion is chiefly grounded vpon these reasons: First because it seemes a most incredible matter, that so much vaporous matter should be engendred vnder the earth, to feed such a perpetuall course of water: Secondly, if all Rivers should not be derived from the sea, no reason could be giuen, why so many riuers daily emptying themselues into the sea, the sea should not encrease, but continue in the same quantity. Thirdly to this purpose they vrge the place of *Eccles: 1. All rivers runne into the sea, and yet the sea is not full: To the place whence they came they returne, that they may flow againe.* But this opinion seemes to be shaken with a great difficulty. For it is a

hard

hard matter to conceive how the water of the sea being by nature heauy, and lower then the superficies of the earth (as we haue demonstrated) should ascend into high monntaines; out of which we find springs of water oftentimes to arise: for either it must ascend *Naturally* or by *Violence*: not naturally for the foresaid cause; because it is a heauy body: If violently, they must assigne some externall Agent, which enforceth it to this violence. This difficulty diuerse Authors haue laboured diverse waies to salue: Some, amongst whom the chiefe was *Theodoret*, haue fled to a supernaturall cause in Gods prouidence; as though the water in it's own nature heauy, should be notwithstanding enforced to the topps of the mountaines; But this opinion seemes very improbable; because, although we cannot deny Gods miraculous and extraordinary working in some things; yet all men haue supposed this to be confin'd within the bounds of nature: And very strange it were to imagine that almighty God in the first institution of nature should impose a perpetuall violence vpon nature. Others, as *Basill*, haue thought that the sea-water was driven vpwards towards the tops of mountaines by reason of certaine spirits enclosed in it: *Mare* (as he saith) *fluitans & permeans per cuniculos fistulares & angustos, mox ubi obl: quis aut certe recta in sublime surrexit excuribus se occupatus deprehenderit ab agitante compulsum spiritu, superficie terra vi disrupta exumpit arg: foras emicat*; The same opinion almost in every respect is ascribed to *Plato* in *Phadone*, & *Pliny* 2 booke. 65 chap. *Quo (inquit) spiritu, altu & terra pondere expressa siphoniam modo emicat, tantoq: a periculo decidendi abest ut in summa quoq: et altissima exiliat: Quaratione manifestum est, quare tot fluminum quotidiano accessu maria non crescant*. But this exposition will hardly satisfy him who desires to search farther then obscurity of words: For first by admitting spirits as movers of the waters, they seeme to fall into a *Platonick* opinion before examined of vs concerning the heat of the sea-water. Secondly, I would deauand whither such spirits in the water to which they ascribe this motion, be *Naturall Agents* or *Supernaturall, or Violent*: They cannot be naturall Agents: For

asinuch as they are supposed to draine and enforce the water against his owne nature. For by nature(as all men know) it is apt to descend; whereas here it is supposed to ascend by reason of such spirits. They cannot be violent agents because they bee perpetuall; whereas no violent thing can be perpetuall. *Thomas Aquinas* being desirous to shew, how much fountaines could ascend out of the sea-water varies in opinion from the former, and it imagines that the fountaines and Rivers water is drawne vpwards through the force of Calestiall bodies, for the common good; to wit that it might water aswell the mettalls in the bowells of the earth, as give moisture and nourishment to *Plants*, and living creatures, dwelling thereon. And this motion(sayth he) although it be against the particular nature of the water, is not altogether violent: because elementary bodies are bound by a certaine law to obey and subie & themselues to the heauenly; so that motions impressed by them, are not enforced on them by violence. For albeit in some sort it thwart the *physicall* disposition; yet haue all creatures an *obedientiall aptnesse*(as they terme it) to submit themselues to the superiour. But this opinion of *Thomas Aquinas* (in my conceit) seemes lesse sound then the former: For first *Thomas* had no need at all of these shifts, holding some of his other grounds: For in another place, comparing the hight of the sea and land one with the other, he firmly maintaines that the sea is aboue the land, and that it is bounded and restrayned from overflowing the dry land, by the immediat power of the Creator: If this be graunted, what need there any ascent or drawing vp of the water, by any extermal power of the heavenly bodies: sith the remitting of this restraint of waters in some places, were sufficient to cause such *springs* and *rivers* in the earth: Secondly, his opinion cannot stand without manifest contradiction of himselfe; for how can the water, being of his owne nature heavy, be drawne vpward without violence and thwarting of nature: And whereas he alleadges for himselfe an *obedientiall aptnesse* in the elementary bodies to obey the superiour, he sha l find very little help to maintain his part. For this *obedientiall* inclination must be either accorde-

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ding to the nature of the water, or opposite vnto it, or at least the one must be subordinat vnto the other: That it is according to the nature of the water, he himselfe disclaimes, and experience refutes; because it naturally *descends*, not *ascends*: if it be opposite (as indeed it must needes be) he contradicthes himselfe: If the *Physicall* and *obedientiall* inclination be subordinat the one to the other; I vrge that subordinat causes can produce no other then subordinate effects; forasmuch as the causes and the effects are measured and proportioned the one by the other. But wee plainly see that the motions of ascent or descent are diametricall opposed, and contrary the one to the other; so that they cannot otherwise proceed, then from opposite and contrary causes. Secondly this obedientiall aptnesse, is commonly vnderstood of a creature, in respect of his Creator, in whose hand it is, as to create all things of nothing, so to reduce all things again into nothing. But this although it be aboue nature, yet no way contradicthes nature: and easier it is to be imagined, that the *Creator* should annihilate any *Creature*, then letting it remaine in his own Nature, giue it a motion against nature: Moreouer if we duly consider nature in her course, we shall find that the *lower & elementall* Bodies onely concurre to the conseruation of the *whole*, and of one another, by following their own priuate inclination: for the *whole* is nothing else then an orderly concenct and harmony of all the parts; from whose mutuall cooperation, it receiuers his perfection; so that where any part failes in his owne office, the *whole* must needs sustain dammage. Thirdly, it will hardly be resolued by any of this opinion, by what meanes or instruments the heauenly or superiour Bodies can haue such an operatiue power ouer the water, as to lift it vpward from his owne Center: for neithier can this thing be performed by *motion*, *light*, or any *Influence*, which are the three meanes of operation of *celestiall Bodies* on *elementary*: I will not stand to proue euery particular in this matter: But onely would haue my aduersary to answe, and giue an instance and speciality. Another opinion there is of *Aristotle*, followed by all *Peripateticks*, who in his first booke of *Meteors*, and 13 Chapter,

goes about to proue and maintaine, that all *Springs* and *Wells* in the Land are produced and generated in the bowells of the Earth by airy vapours resolued into water: which opinion he labours to strengthen in this manner. It is certain (with he) that the Earth hath within it much aire; because *Nature* will no-where admit a *vacuity*. But the Earth hath not onely many open, but a great many secret holes and concavities, which cannot otherwise be filled then with aire. Moreover a great part of the Earth, and other vapours therein contained, and stirred vp by the force of the Starres, are converted into *Aire*; and that aswell the *Aire* included in the bowells of the Earth, as vapours there also bred, are perpetually converted into water: This reason may seeme to perswade, because it followes of necessity, that the coldnesse of the Earth expelling their heat, they should harden & condensate, & be disposed at last to the generation of water: whence also the cause is gien of the generation of water in the middle Region of the *Aire*, although it be not alwayes thence bred: aswell for other causes, as for that the *Aire* by the heat of the Sunne is sometimes too hot, and the vapours are too much attenuated and rarified: so that the matter of *Raine* cannot be alwayes supplyed. This would *Aristotle* haue to be the the originall of all *Springs* and *Fountaines*; So that the water should first distill as it were drop by drop, out of this vaporous matter: and this moist matter so collected and drawne together, should afterwards breake forth out of the ground, and so cause such fountaines: Some reasons are also produced to proue this assertion; for (say the *Authours* of this opinion) If the *Springs* and *Riuers* Should proceed from any other cause, then they shoule take their beginning from *Raine-water*, which is before refuted; or from the *Sea* by certain secret passages, which opinion seemes too weake to endure examination: First, this seemes an argument, that the *Sea-water* is commonly *Salt*, but the water of *Springs* and *Riuers* is for the most *sweet* and *fresh*; and therefore such *Springs* are not derived from the *Sea*: Secondly, because we never find the *Sea* to be emptied, which must needes be, if it should give beginnings to all such currents of water.

in the Earth; Thirdly (we haue already shewed) that the *superficies* of the Earth is higher then the Water; so that it cannot be conceiued how riuers should be derived from the Sea. To this opinion, howsoeuer seeming probable, and supported with the name and authority of so great a *Philosopher*, I dare not wholly assent; forasmuch as it thwarts the Testimony of holy *Scripture*, and cannot otherwise stand with reason: because it cannot well be imagined how so many vapours, and so continually, should be ingendred in the bowels of the earth, to nourish so many and so great currents, as we see springing out of the Earth: for a very great quantity or portion of *Aire* being condensated and made Water, will become but as a little drop: The *Aire*, according to *Aristotle's* grounds being by a *Tenne fold* proportion thinner then the Water. Moreover the *Aire* in these places seated in the *superficies* of the Earth, and higher then other places, and by consequence nearer the Sun, should rather be rarified and thickned; because heat is the greatest cause of rarfaction, as we shall shew hereafter: for the reasons alleged for these opinion, they are drawne only from the weaknes of their assertion, which hold that *Fountains* are derived either from *Raine water*, or from the *Sea*: both which wee haue examined briefly, and whereof wee shall speake hereafter. The Schoole of *Conimbra*, not vterly reiecting all the former opinions, haue vndertaken to forge an opinion (as it were) partaking of all, pretending to say something more, when indeed they produce nothing besides the former. Their Assertion they haue set downe in eight propositions, which I will faithfully set downe, and then censure. The first is that in *subterranean* places vnder the superficies of the earth, is hid a great quantity of water, distinguished into *Rivers*, *Ponds*, and *Lakes*. This they proue from the daily experimt of such as d^r eggs diverse wells and deepe trenches in the Earth; Who many times vnder the Earth, find not only many rivers and ponds, but many times happen vpon so great abundance of Water, that they can neither find the bottome or bounds thereof. To this they add an experimt of *Philip of Macedon* recorded by *Asclapiadorm* who

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who caused many men expert in digging of mettalls, to be let downe into an old and forsaken *mine* to search out the veines of mettalls, to see where the covetousnesse of antiquity had left any thing to posterity. These men vsing great lights are said to haue found nothing there, but great and vaste riuers and great receptacles of waters. This they also labour to confirme by many and soddaine eruptions and breaking out of waters out of the earth, whereof we shall haue occasion to speake more heareafter. This first position, howsoever in it selfe true enough, seemes little to the purpose; but we will proceed to the second, which is this: That when God in the third day of the Creation separated the waters into one place, and hidd it in the caverns and secret receptacles of the earth; at the same time dispersed into diverse parts of the earth, a great quantity of water by diverse occult passages and channells, whence comes that great masse of waters vnder the earth; which is before mentioned. This they seeme to perswade by reasons for (say they) as the wise *Architect* of all for mans sake, and the rest of living creatures for the vse of man, hath discovered the dry land, by restrayning all the waters into one place: so it was most necessary, that he should inwardly water the earth; by which stones, mettalls, minerals, & other such things in the bowells of the Earth, should in time grow and increase. Also that some water should from hence b[e]ake vp out of the Earth, for diverse causes heareafter specified. Finally as *Philo-Iudeus* affirmes, for the continuatiōn of the parts of the earth, which otherwise might by drouth be separated and divided. The third proposition grounded on the two former is this; That many rivers and fountaines in divers places by God's decree arise out of the earth, by quantities of waters hid in the cavernes of the earth, which they proue by reasons drawne from the vtility of such fountaines and rivers, springing out of the earth. Fourthly they defend, that all fountaines and currents were not so made and appoyneted in the first *Creation*; because Histories & experience teach vs, that many haue broken out of the ground afterwards; whereof we shall haue occasion to speake heareafter. Fiftly they

they affirme, that if the opinion of Aristotle be vnderstood of all fountaines and flouds, it cannot be approved; for as much as it seemes sufficiently declared in the third opinion, how such rivers might be generated without such vapours; as also because many arguments and places of *holy Scripture*, seeme to proue the contrary. As also the foure Rivers of *Paradise* created in the beginning of the world, cannot be guesst to draw their originall from such vapours, as Aristotle imagines; to which accord many ancient Fathers vpon these places recited in that opinion, whereas all rivers are thought to fetch their originall from the sea. Sixtly for the credit of their master Aristotle, they are constrained to averre that although his opinion cannot be verified of all rivers and fountaines of the earth, yet if it be restrayned to some such perpetual currents, it may haue probability. Forasmuch as we are to belieue that many such large caverns and holes are hid vnder the earth, in which no small quantity of vapours may be engendred. This probability is greater in those riuers which are lesser in quantity then the greater, for the reasons before shewed. Sevently they affirme that it is absolutely to be believed; that not only great rivers and currents are derived from subterranean waters, which haue originall from the sea; but also lesse fountaines and springs for the most part, challenge the same beginning: whence they labour to proue by this reason, that in very few places of the earth there is found so perpetuall and apt disposition of vapours vnder the ground, as to nourish so many, and so great currents of water. Eightly (say they) it cannot be denied, but that Waters aswell proceeding from raine, as that which is generated of vapours in the caverns of the earth, sometimes may flow into fountaines and rivers: What concernes Torrents bredd of raine, they haue recourse to the reasons of the first opinion: for others they make it also probable; because we see by experiance that Vapours and Aire compassed about with earth, are by reason of the colde environing it, turned into water. This is indeed the opinion of those subtil *lesuits* of *Conimbra*, wherein although they giue a flourish, as if they would defend their master

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master *Aristotle*, on whom they comment; yet meane they nothing lesse; but indeed warily sticke to the other of the *Divines* and *ancient Fathers* of the Church, touching the derivation of all torrents from the sea: Which opinion, howsoever in it selfe most probable, they know not how to manage and defend against opposition. For whereas they suppose that in the first separation of the sea from the *dry-land*, a great quantity of water was dispersed into diverse hollow places & caverns of the earth, from whence Rivers are derived and made; they haue not in any probable manner expressed, how this water should perpetually flow, and feed so many & great currents: For first, I would aske of these learned fathers, whether the water inclosed in the bowells of the earth, whence these springs are fed, be *higher* or *lower* then the fountaines arising out of them. If it be higher; whither the Rivers are continually nourished on the old store, or a new supply be daily made. That so great rivers should be maintained so many thousand yeares out of the old provision, is most improbable; because the mountaines out of which such springs arise, cannot be capable of so great a concavity: neither can it otherwise be imagined, but that many great rivers since the beginning, had either bin absolutely dried vp, or at least diminished in their quantity, their Cisternes being daily more and more emptied out into their channells. If they graunt that of this water, a fresh supply be made; it must be either from the sea or from *vapours* in the earth. It cannot be from the sea: because (as we haue proued before) the sea is lower then the fountaines, where springs breake out of the Earth; forasmuch as we see them runne to the sea from their fountaines, as from a *higher* to a *lower* place. That this supply of water in the depth of the earth should be made by *vapours*, it is also improbable in their opinion; who cannot imagine so many engendred in one place, as to feed so great currents; as also because many rivers were apparent in the first creation, as the four great currents of *Paradise*. This objection hath so farre driven the *Jesuits* to their shifts, as that they haue bin enforced to haue recourse to the opinion of *Thomas Aquinas*,

Aquinus, who dreames that the waters are enforced vpwards, by the influence of the *heavens*, which they a little before cast by, and we haue before sufficiently refuted. And whereas in the subsequent clause, they labour to salue this place of *Ecclesiastes* : *That all Rivers come from the sea, and returne thither againe;* They are constrained to leaue their old grounds, and runne backe to *Aristotle*, who holds that all rivers had their originall from *vapours*, drawne vp by the sunne; where-*o* the *sea* is the chiefe mother. Ir wilbe expected at least that we should disclose our owne opinion, hauing censured the former: which we will briefly doe as neere as probability can lead vs, submitting all to those which are more iudicious. First therefore, we will suppose as probable: that the earth is in a manner compassed round about with water; for howsoe-*ver* the places more eminent, and separated for our habitati-*on*, be dry land, yet not farre vnder the superficies of the earth, whereon we tread, is the earth sprinckled round with water, for which we may draw an argument; as well frō the *Porous* and *spongy* nature of the *Earth*, which is apt to driake in the water of the *sea*, in the same hight; (because it is the nature of the water, to diffuse it selfe abroad) as also from experi-*ence* of *Miners* and such as digg deepe into the earth, who in most parts find water. 2^{ly}, this water so environing the earth, were it left to it's own naturall situation, without an exter-*nal* Agent, would lift his superficies no higher, then the superficies of the *sea*; because being as one with the *sea*, it will challenge the same *Spherical* superficies. Now to know how the water thus naturally settled, is notwithstanding lifted vp higher to become the source of *Springs*, we must under-*stand*, that it comes to passe not onely by the heat of the sunne and *starres*, piercing farre vnder the superficies of the earth, according to the circle, we haue allotted to the water. But also to *subterranean fires* hid in the bowells of the earth, in many places: which are caused by *sulphurous* matter set on fire by the sunne, or some other accident: whether this *sulphu-
rous* matter be pure *Brimstone*, or *Bitumen*, or a mine of *sea-
scale*, as some haue thought of our *Bathes* in *England*, I

will not curiously here dispute, being of it self too large a subiect for me in this place to handle. This heat may be conceived to concur to the production of fountaines & manner of waies: First, by drawing vp diverse moist vapours, which by reason of the *thicknesse* and solidity of the earth, being not presently evaporated out of the superficies of the earth, are enforced to disperse themselues through divers crooked passages, where condensated by cold distilling againe into drops of water, they breake out through some place of the earth, and so become a fountaine. A second way which may also seeme probable, is that the *Heat* pearcing the *Subterranea Water*, though not able to dissolve much of it into vapours for the solidity of the earth, may notwithstanding through his heat, *Rarifie* and attenuate these waters. These waters then rarified, must needs seeke a greater place, wherin they may be contained: sith *Rarefaction* is nothing else but the extension of a body to a greater place then before it occupied. Hence is the Water enforced to enlarge his limitts: This enlargement or the place cannot be downward towards the Center; because all that place was supposed to be filled vp as farre as the Earth could drinke it. Wheresore it must needs extend it's limits *sidewise* or *upwards*: By the former of which it may find a passage to breake forth on the superficies of the ground: By the later it may be lifted high enough, to runne from the side of a higher mountaine, towards the *Sea-shore*. If any man should aske why this *Rarefaction* & swelling of the Water is not so sensible in the open *Ocean*: I answeare that the sea is also much rarified and lifted vp by reason of the sunnes heat: which whether it be the cause of ebbing and flowing of the sea, in part we haue before disputed. Secondly that the *sea-water* should not rise so high as other Water vnder the ground, these reasons may be giuen; First that the *Ocean* hath a larger channell to runne abroad on either side, and so this swelling must of necessity become more insensible, whereas the Waters in caverns & concavities of the Earth, being oftentimes straightly bounded on either side, by the narrownesse of the channell, must of necessity take vp the more in hight & eminency. 2

the Sunne, heauenly bodies and subterranean fires worke, more strongly and effectually on the open nakednes of the sea, then on the waters hid ynder the ground, which are more shrowded from such an extreame heat. Whence it comes to passe, that many parts of the sea, are dissoluued into vapours, and so consumed and dispelled by the same; Whereas this heat in the Subterranean waters being more moderatly impressed; doeth not dissolute into vapours, and consume so great a quantity of water; but being of a middle temper, rather rarifies it to the vse forenamed. This seemes the more probable, because spring water rasing commonly in the sides of mountaines, is for the most part thinner then the Sea-water, as experience dayly warrants. Thirdly, the subterranean vapours are sooner dissolute into dropps of water by reason of the cold they must necessarily meeke within their passage, through the Earth; whereas the other from the Sea meet with no such encounter till they arrive at the Middle-Region of the Aire, whence they returne againe in shrowres of Raine.

2 All Riuers and Fountaines were not from the beginning.

For the confirmation of this assertion, many histories may be produced: It is reported that in *Caria* neare about the city *Lorus*, there arose out of the Earth suddenly a great floud of Water, bringing out with it a great quantity of creatures and fishes, of which being fatted ynder the Earth, whosoever chanced to eat, dyed presently. The like is reported, that at the time of the *Mythridatrick* warre, at a certain city of *Phrygia* named *Apamea*, there sprang vp out of the ground many new *Lakes*, *Fountaines*, and *Brookes*; and that one riuier sprang vp very salt, which brought vp with it a great quantity of *Oysters*, and other *Sea-fishes*; although the City *Apamea* be very farre off from the *Sea*. This is reported by *Nicolaus Damascene*. Also *Cardinall Contarenus* testifies in the second booke of *Elements*, that in a cleare day being in *Valentia* in *Spaine*, there happened a very great *Inundation* of water breaking out of the Earth, which being carried towards the City,

had well neare turned it into the Sea, had not the gates bin
shut, and damnes well ordered. Why this sudde[n]e change
should sometimes happen, many reasons may be produced.
The first reason may be, because of some iuddaine ruine or fal-
ling downe of some parts of the Earth, whereby the courses
of the riuers being one way stopped, must needes seeke out a
passage some other way. This oftentimes happens in great
Earth-quakes, as we may read in *Theophrastus*, that in the
mountaine *Coricus*, after an Earth-quake many new springs
and fountaines discouered themselues. Another reaon not
much vnlike the former is giuen from the *Hardnes* of the
Earth, which oftentimes stopping and hindering the naturall
course of the water, enforceth it to seeke a new passage. Hence
the foresaid *Theophrastus* was induced to believe, that in a Ci-
ty of Crete the fountaines were stopped vp because the Inha-
bitants betooke themselues to another place; so that the soile
was not so much shooke and moued as before. A third reason
may be the wasting or cutting downe of great woods on the
Earth; for it is the nature of the Trees and plants to suck to
themselues the Moisture of the ground into one place. But
these trees cut downe or remoued, the waters course must
needes be altered.

3. Many Rivers are for a great space of land
swallowed vp of the Earth: whereof some af-
ter a certaine distance rise againe.

This is confirmed by many historica[n] instances, as of the
river *Timanus* in the province of *Aquila*, of *Erasenus* in *Argo-
lica*, *Padus* in the *Alpes*; more remarkeable is that of the river
Guadiana in *Spaine*, which runneth vnder the ground, for the
space of 13 leagues, and neare to a towne called *Villa Horta*
breakes vp againe: the like is re[order] of *Eurotas* in *Arcadia*,
which is said to breake forth of the ground in the province of
Lacedamon: So *Cadmus* in *Asia* is swallowed vp in a hole of
the ground, not farre from *Laodicea*: so *Pyramus* in *Cataonia*,
Licus in *Libanon*, *Orontes* in *Syria*. Other riuers are thought to
haue found a secret passage vnder the sea from one Region to

another : As a riuer hauing his fountaine in the mountaine *Meiates*, which being convayed in a blind Chaunnell vnder the middle of the sea , comes forth againe at the port of *Panormus*: so others report of *Alpheus*, which being drowned vnder ground neare the *Peloponnesian* shore, takes a large iorney vnder the Sea, till it arive at *Syracuse*, where it ends in *Aethuse*; which brings forth (they say) such things as are cast into *Alpheus*: which is much like that which is spoken of the Well of *Aesculapius* in *Athens* , wherein if any thing were cast, they were rendered againe in *Phalericus* : But this last I rather hold as a poëticall fiction, then a true History. Some riuers there are which are not wholly drowned in the earth; but for some part; as a part of the *Rhone* , which is hid about foure thousand paces from the city *Cauba*, and shewes it selfe againe before it come to *Bonna*: in like manner a part of *Danubius* which hides it selfe about *Greina* a Towne of *Panonia Superior*: some riuers there are againe , which are not drunke vp immediatly of the earth, but of certaine great *Lakes* into which they fall; as *Jordan* of the *Lake Asphaltites*: some lakes againe hauing swallowed vp riuers (as it were) vomit them forth againe: as *Rubresius* casts out *Arace* in the Province of *Narbon*; and so *Lemannus* the riuer *Rhodanus* in the same Province: also in *Italy*, *Lorus* casts out *Abdua*; *Eupilius*, *Lambre*; *Fucinus*, *Marcia*.

4 *Riuers for the most part rise out of grent Mountaines, and at last by diuurse or one flet, are disburthened into the sea.*

The first part of this propositio is manifest enough out of diuers instances of the greatest rivers in the world: for all Geographers will give you to vnderstand, that the riuer *Indus* in *India* is derived from the mounraine *Caucasus*. *Tanais* from the *Riphaean* mountaines in *Sarmatia*, *Araxis* from *Panardes* in *Armenia*, *Po* from the *Vesuvian* Hills in *Liguria*, *Danubius* from *Arnebia* in *Germany*, *Exesius* in *Norico* from the mounaines; *Elacha Isara* from the ridge of the *Alpes* toward *France* and *Durius* toward *Italy* from thence. So from the *Hermanian*

mountaines in Portugall are derived three great Rivers: So *Nilus* in Africk from the mountaines of the *Moone*: These riuers thus rising, are of diverse kinds; for some haue visible apparant springs and fountaines: others are derived from Lakes, out of which they runne. As *Alba* in *Prusia*, out of *Elbinga*, *Medoarus* & *Oxus* out of two lakes of the same names, neere the *Alpes*; *Rindacus* from *Artinia* a poole besides *Melitopolis*. The reason why rivers should be engendred in mountaines, and such high places, may be given; because they are made (as we shewed before) by the heat of the sunne, starres and subterranean fires, rarifying and attenuating the Waters. And this operation of the sunne in higher places, must needs be more effectuall then in lower. Now for the second part, it is plaine to proue, that all rivers run into the sea: either making a passage from their fountaines, on the land toward the sea shore, as *Nilus* & *Danubius*, with other rivers, or by disburthening themseluers into greater Rivers, wherin they are convaied into the sea: as the 60 great Navigable rivers, which emptie themselues into *Danubius*, or at least are swallowed vp of the Earth, and so reduced againe to their first mother; which we may imagin of the rivers forespoken of, drunk vp of the Earth: Although all rivers (as we shewed) fall into the sea, yet not all in one & the selfsame fashion; if we respect their passage on the land. For some are caried into the sea by one *ostium* or mouth, whereof we haue two notable examples; the first of a great river in *Brasil* called *Rio de La Plate*, which is caried into the sea, by a mouth of 40 leagues, with such violence, that the Mariners may thence draw fresh water before they come within sight of land. The other not much unlike, is that which runnes by the kingdome of *Congo* & *Angolo*, which is six and thirty thousand paces broad, where it enters into the sea, and is carried with such a force, that it severs the waues, & keeps his owne chaniell, and renders the shipp-men fresh water betwixt the sea waters, for the distance of eight hundred thousand paces. Other great rivers are disburthened into the sea, by diners *ostia* or *Inlets*; as *Rhene* into the *Germane Ocean* by three; *Danubius* into the *Ponticke sea*, by 6; *Indus* into the

the Indian sea by 7; Nilus into the Mediterranean by 7 great and famous passages: Volga into the Caspian lake by 72 gates. These are the most remarkable: others we shall supply in our historicall part.

5 Diverse fountaines are endowed with diverse admirable vertues and operations.

There is nothing wherein Nature delighteth more in ridiculous variety, then in fountaines and springs of the earth. Of these admirable workes of nature, being infinite in these springs, I will touch some. Which the better to effect, I will reduce all to these heads. 1 Their qualities and operations. 2 their Motiōs: For the former we will produce some few instances. It is reported, that neere the *Garamantes* there is a fountaine so cold in the dayes that no man can drinke thereof; so hot in the nightes, that no man can abide to touch it: There is another in *India* wherein a candle will burne. There is also another called heeretofore the well of *Jupiter Hammon* which in the morning is like-warme: at noone cold, in the evening Hot, at midnight boiling hot; From whence againe it begins to asswage till the morning; and so (as it were) by turne it growes hott and cold; a matter of great admiration. Some fountaines in *Liguria* & *Paphlagonia* being drunke will make the head giddy as if he had drunke wine: Another fountaine in *Aranea* a part of *Arcadia* being drunke, will so affect the tast, that who drinks it shall neuer afterward endure the tast of wine: which was very like the fountaine *Clitorius* wherof *Ovid* in his *Metamorphosis* the last booke sings in this manner:

*Clitorio quicunq; suim de fonte levārit,
Vina fugit, gaudetq; meris abstemias vndis.*

The ancients haue also recorded, that in *Bæotia* neere the river *Orchomenon*, are two fountaines; whereof the one gets memory, the other causeth oblivion. There is in the land *Cea* a fountaine making the senses dull; an other in *Aethiopia*, whereo the Water drunken will make a man madd: Some water absolutely kills him which drinke, as the riuer *Styx* in *Arcadia*, being a venomous fretting poison, and therefore

by the poets fained to be one of the riuers in Hell. Divers other rivers are profitable to cure divers diseases of the body, whereof I need not bring any instances; because such new-found wells are sometimes discovered amongst vs here at home. There are 2 rivers in *Bœotia* of admirable vertue, whereof the former, if a sheep drinke of it, he will become yellow: but if a sheep of a dunne or yellow colour drinke of the other, he will become white: Rivers which make sheep white coloured besides, are *Nelens* in *Eubœa*, *Aliacmon* in *Macedonia*: *Crathris* in *Thurijs*: so *Cerens* in *Eubœa*, *Auxins* in *Macedonia*, *Peneas* in *Thessaly*, will make them blacke: *Clytumus* will cause whitenesse in oxen: So the riuers *Astaces* in *Pontus* waters the land, wherby mares haue their milke blacke. Amongst the regions of the *Troglodites*, there is a well which thrice a day will become sweet and bitter, and againe returne to his former sweetnesse, and so often againe in the night. This may suffice to shew the variety of operations in these wells, in respect of other creatures. No lesse admirable variety is discouered in obseruing of their diuerse motions. For some riuers overflow their bankes at some certaine times of the yeare, as *Nilus* in *Egypt*, *Euphrates* in *Mesopotamia*, *Indus* in *India*: some fountaines are carried with such violence, that they cast vp stones, as *Marsia* in *Phrygia*, and expell any weight as a certaine one in *Arabia*, whereof the like was recorded to be in *Portugall*: some will swallow vp any thing throwne into them; as one in *Portugall*, if we belieue *Pliny*: some others although they are cold, will seeth and seeme to boile as the water on the fire; yet neuert cast out their water beyond their bankes, but straigh-way swallow it vp againe, as *Acidula* in *Albogano*, and another fountaine in *Cappadocia* named *Tiana*: some there are which sometimes rise and swell, and other times fall againe of their owne accord, as *Crater* of *Turinge*, and a fountaine in *Italy* called *Pluviana*: some wells imitate the ebbing and flowing of the sea in all encreases and diminutions, as one in *Cales*, and the other neare *Burdeaux* in *France*: some are contrariwise affected to the ebbing & flowing of the sea, flowing when the sea ebbs, and ebbing when the sea

sea flowes as certaine Pits in Spaine: some encrease and diminish without any consent or agreement with the motion of the sea; as a Well in *Tenedos*, an Iland neare *Troy*. In *Cantabria* are three fountaines, distant 8 foot the one from the other, and falling into one Channell in a waste riuver, which euery day are dry twelue times, and sometimes twenty times: others of their own accord purge & cleanse themselues, casting out wood, clay, durt, & other matters wherewith they are defiled, as a Well in the *Chersonesus* of *Rhodes*. These and many more remarkable instances haue our naturall Historians gathered together, whereof though some perhaps may be thought to be forged of Poëts for pleasure, or mistaken for want of good discouery and obseruation; yet maist we not wrong Antiquity so much as to reiect all, hauing in this subiect enough to wonder at in our owa Country.

6 Places neare great Riuers and Lakes are most commodious for habitation.

It hath bin the custome of all times and nations almost in the world, to choose out for a choice place for building of cities, their habitation neare some great *Lake Riuer*, or *Arme* of the Sea; which sprang from the common obseruation of Men, who found such places to be more convenient. This convenience is shewed many wayes: first, because by meanes of such water they haue quick *passage* and *traffiske* with other Nations, being able with more ease both to receiue, &c to send forth wares and marchandise: Whence we see that such cities as are seated vpon the water, are commonly of all other the richest: whereof we may giue an instance almost in every country, as of *Senill* and *Lisbone* in *Spaine* & *Portugall*: of all the Cities almost of the *Low-countries*; of *Paris* in *France*: whence (no doubt) grew that English Proverbe; *That the Sea is a good neighbour*; which may aswell be vnderstood of any navigable Riuer. Secondly, such a site is most convenient for the purging away of all filth and excrements, which could not with the like conveniency be so soone transported by land: whence many men haue laboured to transport riuers far

remote vnto Cities. Thirdly, because such riuers and watry lakes yeeld store of *fish*, whereby the Inhabitants may be nouished, and other creatures the better preserued: Fourthly, no small commodity would accrue to a City by water neare adjoyning. If it should chance (as often it doth) to be set on fire; for hauing water neare it, it may soone be quenched: whereas many little springs cannot afford so much water as would suffice for such a purpose. Lastly, amongst other reasons we cannot forget the pleasantnes of faire riuers, which are no smal ornaments to a City, and delights to the eye of the Inhabitants.

8 Thus much for rivers: A Lake is a collection of perpetuall Waters, nourished with fresh springs, and having of it selfe no passage forth.

In this definition of a Lake, we haue comprized these three things: First that it is a collection of constant and perpetuall waters: Secondly, that it is continually fed & cherisched with fresh springs, rising vp from the bottome. Thirdly, that it finds no passage forth into the sea or otherwise. By the two first it is distinguished from a great *Pond* or standing poole called in Latin *Stagnus*: Forasmuch as a standing poole, being commonly fed with raine water, and hauing no springs from the Earth whereby it may be long nouished, is often-times by the heat of the sunne exhausting it out by vapours, either extraordinarily diminished, or altogether dried vp: Whereas in a Lake by reason of fresh springs, the Water is perpetuall and remaineth sweet and holosome, except by some other accidents, it change it's disposition. For the latter clause that a lake finds no passage forth, it may be two waies vnderstood: either of a *visible* or apparant passage outwardly through the superficies of the Earth to the sea, or of a *secret* and subterranea passage vnder ground: The former may againe be vnderstood of a passage forth immediatly by it self, or mediately by some riuer: whereas wee haue said that it finds

finds no entrance into the sea, we ought to understand it, that immediatly it is not to be accompted a continuat part con-
ioyed with the sea: neuerthelesse it may be disburthened into
the sea by some rivers running out of it, as some woulde haue
the great river *Tanais* not to haue his head or fountaine in the
Riphaean mountains, as the ancients haue taught, but in a cer-
tain Lake not farre from the city *Tula*: so *Volga* & *Edill* draw
their originall from a lake not farre from *Moscow*: with many
others of like nature. What to thinke of the *subterranean* in-
tercourse betwixt Lakes and the sea, we will shew in this
Thoreme.

I *It is probable, that most Lakes haue some se-
cret intercourse with the sea vnder ground.*

For the confirmation of this point, there want not reasons: The first reason may be drawne from the quantity of Water in most Lakes, which is found without any great sensible differenc to remaine the same, without any dimiuntion or encrease; whereas if the water bound in with these limits, should haue no passage out any way, it shoulde encrease to such greatnes, that it woulde easilly ovr-whelme the bankes. To giue a few instances, we find that diverse very vast rivers ex-
haust themselues into the *Caspian* Lake as *Volga* & *Edill*, which receiving into them many notable riuers, are at last themselues swallowed vp in the said lake: In like manner the Lake of *Palestine* called the *dead sea*, is known to receiue into it besides diverse lesser riuers, the great and famous riuer *Ior-
dan*. Heere woulde I demaund, whether these great riuers perpetually casting themselues into a Lake, giue an encrease to the former quantity or not: if they shoulde augment the water, they woulde by consequence alter the bounds: But this is contradicted by experience. If the quantity of the water suffers no encrease, it must needs follow then, that the wa-
ter shoulde some other way be diminished, as it is heere encreas-
ed. This must either be by the sunne drawing vp some parts of it by vapours, or by some caverns of the Earth, drinking vp some parts of it: Or lastly by a *subterranean* passage into

the sea: Concerning the former it cannot be denied, but much Water is drawne vp into vapours by the heat of the sun, yet that these vapours countervale the water perpetually brought in, is in my conceit very improbable: for against this quantity of water extracted out this way of evaporation, I will oppose these three things which shall perswade a reasonable man, that the water received in, shall farre surpassee the vapours exhaled from it: First that the vapours are stirred vp in the day time, when the sunne is lifted aboue the *Horizon*; at such a height that his heat is somewhat strengthned, wheras all these watry currents never intermitting their vsuall course, never cease to runne by day or night: wherin is seene a double aduantage of the riuers, in respect of the watry exhalation: Secondly of these watry vapours, so drawne out, a great part must at diverse times returne back, or at least so much otherwise by *rainy* shewres, dropped downe into this *Lake*. Thirdly, these watry parts thus rarified & attenuated in vapour should (putting this supposition) in equality, diffuse themselves abroad in such extraordinary manner, that all the Regions round about should in all likely-hood suffer a great inconueniency of foggy exhalations. On the other side it is very vnlikely, that it should bee received into empty caverns of the Earth, without passage into the sea, or some great riuor disburthening it selfe therewinto. For I would demand whether these caverns were ever filled with water or not: if they haue bin filled, how could they receive more water, sith the filling of any place supposeth it to be first empty. That they were never yet filled with Water, is farre more vreasonable: that any man should imagine, any cave of the Earth to be so vast, which so great cur rents of Water perpetually running in almost six thousand yeares, should not replenish: especially considering the bowells of the Earth, not farre from the upper face, to be every where spread with Water round, which might also helpe to this purpose: Wherefore it cannot well be imagined but that every such great lake, hath some vent or passage unto the sea, either by some secret & subterranea channell, or

at
at
at

at least by some great river issuing out of it, and so running into the Ocean. And her reason may be taken from the currents of some seas, which are by good reason ascribed to this cause: For it is observed by skilfull Nauigatours, that the Water is carried by a very stiffe course from *Propontis* and the black sea into the *Aegaean*, and from thence into the *Mediterranean*: The originall of which current may with good conjecture be found out in the *Caspian*, which by some secret passage vnder ground, disburthening it selfe into the black sea, caufeth it to enforce his owne waters farther of, for the receite of the other. Thirdly that these subterranean passages are not unlikely, may be confirmed by many rivers which are swallowed vp, some wholly, some for some place only of the Earth, whereof we haue spoken before. Also it may seeme likely by the Water, spread round about the Earth, which through the bowells of it finds a passage from the sea, bearing as it seemes the same levell. This may (for ought we know) be the originall of all *Lakes*, and this also may be a way or meane, whereby they empty and disburthen themselves, being overcharged with too much Water.

C H A P. X.

Of Mountaines, Valleyes, Plaine Regions, Woods, and Champian Countreyes.

He second variation in the figure of the Earth is expressed in Mountaines, Valleyes, and Plaine Countreyes. A Mountaine is a quantity of Earth heaped aboue the ordinary height

of the Land. A Valley is the depth of the Earth between two Mountaines. A Plaine is a space of Earth where there is found no notable rising or falling of the ground.

The distinction of the Earth according to it's externall figurature into *Mountaines, Valleyes, and Plaines* is very naturall; because every space or parcell of land in respect of the places neare or about it, must either rise higher, or fall lower, or at least must beare an equality; where the former is admitted, there must needs be *Mountaines* swelling higher then the ordinary leuell of the Earth; where the second is found, the ground is indented with *Valleyes* and *concavities*: where the third is to be seene, there must be *Plaines*. Here is to be noted that howsoeuer *Plaines*; absolutely considered, haue a sphaericall surface for the most part, especially if the *Plaines* be large, because they concurre as circular segments to make vp the *Spheare* of the Earth; yet they may be called *Plaines*, because they so appeare to our sense, which in so short a distance, cannot perceiue the *Sphaericall* figurature of the Earth; Some *Grammarians* here curiously distinguish between *mons* or a *Mountaine*, and *Collis* or a *Hillock*, which is a little hill; & also betwixt *Vallis*, which they would haue to be a low parcell of ground betwixt two mountaines, and *Convallis* which is a lower space, only bounded on one part by a *mountaine*, which *Varry* would haue to be derived from *Cavata vallis*; but these *Grammatical* scruples are of small vse to such as spend themselves on greater matters: because the ordinary & vsual manner of speech(euen amongst the vulgar) will shut out all mistakes in this kind; what deserues the study of a *Topographer* concerning this, shall be expressed in these *Theoremes*.

I. Mountaines, Valleyes, and Plaines were created in the Earth from the beginning, and few made by the violence of the Deluge.

It

It hath bin the opinion of some , aswell *Dinines* as *Philosophers* , that the violence of the *Deluge* hath extraordinarily altered & defaced the Earth, being the chiefe cause of *Mountaines* & *Valleyes* therein: but this opinion is contradicted by many reasons: first out of the Text it selfe of *Genesis*, where it is said, that the water of the flood ouer-flowed by 15 Cubits the higest Mountaines: to which may be added the Testimony of *Damascenus*, who report, that in the time of the *Deluge*, many resorted to a high mountaine of *Armenia*, called *Baris*, where they saued theselues which last clause although it expresaely contradict the holy *Scriptures*, which speake but of Eight Persons that were saued: yet it is a sufficient testimony to proue that such Mountaines were before the Flood , & therefore not made by it : Secondly had there followed so great an alteration of the Earth, to cause *mountaines* as some imagine, then should not the same places after the flood retain their names, bounds, and descriptions, which they did before the flood; the contrary whereof we find, in that *Moses* writing of *Paradice*, & other places, about 850 yeares after the flood, was most exact in setting down the *Names*, *Limits*, & whole description of them, as though they had remained to be seene in his dayes. Thirdly, had the violence of the waters beeene so great as to raise vp mountaines in the Earth, it would without doubt haue bin forceable enough to haue turned *Rivers*, and haue changed them from one place to another , cast downe & demolished the greatest Cities and buildings , throwane downe and ouer-whelmed all plants and vegetalls on the Earth , and (as it were) haue buried from all succeeding time, the memories of the former ages, so that little or nothing should appeare : but this may bee proued otherwise by sundry Instances : First that the the *Rivers* haue still remained the same , may appeare out of the place alleged of *Genesis*, where *Moses* speaking of the site of *Paradice*, set downe all the rivers of it exactly, especially *Tygris* & *Euphrates*: out of the which we may easily gather in what *longitude* & *latitude* it stood: had any thing bin altered in the course of the rivers, it is likely *Moses* would haue specified:

fied it in this *Historie*, that after ages looking for these places, might not mistake or suspect the truth of his Relation: Secondly, that it hath not extinguished all *Buildings*, and ancient monuments of the fathers before the flood, may probably be conjectured by the testimony of *Iosephus* a writer of good credit, who affirmeth that he saw one of the pillars, erected by *Seth*, the second from *Adam*; which pillars were set vp aboue 1426 yeares before the flood, accompting *Seth* to be a hundred yeares old at the erection of them, and *Iosephus* himselfe to haue liued some 40 or 50 yeares after *Christ*; Now although we are not bound to credit all that he relates; yet may we trust him concerning such matters as happened in his time; and that this pillar was set vp by *Seth* was neuer yet called in question, but warranted by *antiquity*: the like is recorded by *Berosus* of the City of *Enoch*, that it was not demolished by the flood; but remained many yeares after, the raines whereof as *Annius* in his commentary reports, were to be seene in his time, who liued in the time of *Ferdinand* and *Isabella* of *Castile*. It is also reported by *Pomponius Mela*, that the City of *Ioppa* was built before the flood, of which *Cepha* was King, whose name with his brother *Phitius* together with the grounds and principles of their religion, were found grauen vpon Altars of stone: All which are sufficient to proue the violence of the Waters, not to haue bin so great to demolish all *mountaines* & *monuments*; Moreouer it may be plainly proued out of the text, that the Water suffered the plants and trees of the Earth to grow, and remaine as they did before; because it is said, that when *Noah* the second time sent out the *Dove*, she returned with an *olive* branch in her mouth, which no doubt she had plucked from the trees, after the trees were vncouered; for otherwise shic might the first time haue found it floating on the Waters: a manifest proof that the trees were not torn vp by the roots, or turned topsy turvy, but remained fixed in the Earth as they did before. Fourthly, had the water suffered this extreame violent motion, as whereby it might make many mountaines, I aske wheuce this motion should come? it could not be from the natural

naturall motion of the water, which is to moue downward; for what descent of waters can be in a *Sphericall* or round body, where no part is higher, or lower? That there was any wind to drie and enrage the Waters, is very unlikely; because it is said, that God caused a wind to passe vpon the Earth, and the Waters ceased; so that there was no wind till the Waters sanke: Lastly, we may argue from a *finall cause*, that this *inæquality* in the superficies of the Earth was before, the flood; because it is certaine that all things were in as good or better estate, then now with vs, and that the Earth was adorned with all varieties of creatures as well for *profit* as *delicacy*. Now it is found by experience, that all commodities agree not to all places, but some are found in the mountaines, as all sorts of mettalls & mineralls, Plants, & Vegetalls for the most part prosper best in the vallies and plaines: Also that the mountaines serue for a shelter to guard the vallies from the rigor of *cold* and *wind*, both for the better conuenience of mans life, and encrease of fruits for the vse of man: Whence we may conclude, that it is farre more probable, that the great *Mountaines* were so created in the beginning, and not made by the flood; yet can we not deny, but that some small *Hillockes* might be made by the flood, and afterward by the industrie of man, which haue raised great fortresses, & bulwarks, which afterward decaied, were made great heapes of Earth (as we see many in this land) but this is of small note & not worthy consideration, in comparison of the great mountaines of the Earth whereof we especially treat.

2 *The perpendicular height of the highest mountaines seldome exceeds 10 furlongs.*

This proposition depends on the authority of *Eratosthenes* a famous *Mathematician*, who being employed by his King, found out by *Dioptrick Instruments* the height of the highest mountaines, not to exceed the quantity aboue specified. *Cleomedes* extends this a litle farther, and would haue some mountaines to attaine the height of 15 furlongs, of which height he would haue an high rock in *Bactriana* called by

Strabo 11 Isbro Sisimitra Petra; But yet if we credit *Pliny* or *Dicaearchus* who measured the Mountain *Pelion* accópted the highest, he found it not to exceed 1250 parts which make 10 furlongs: and *Solinus* relates the mountaines of *Thessaly* to be higher then else-where are to be found. But this opinion howsoeuer supported by the authority of the ancient and famous *Mathematicians*, hath bin called in quæstion as well by moderne, as ancient writers. Many matters are miraculously, or rather fabulously spoken of the Mountaine *Athos* in *Macedonia*, of *Cassius* in *Syria*, and another of the same name in *Arabia*, of the mountaine *Caucasus*, and others: which Histories notwithstanding are related by no meaner Authors then *Aristotle*, *Mela*, *Pliny*, and *Solinus*; yet it is not hard to imagine, that these Authors might be deceiued in those times, either trusting to other mens relations, or wanting *Mathematicall* instruments, to search these matters: Of the Mountaine *Athos* it is much wondred at, that it should cast a shadow from *Macedonia* into the market-place of *Myrhina* a towne of the Iland *Lemnos*, distant from *Athos* 86 miles: But this as our learned Countriman *M^r Hus* well obserues, can be no great argument of such a miraculous height; because the mountaine *Athos* situat East from *Lemnos* (as may be gathered from *Ptolomies* Tables) may without any great wonder cast a very long shadow, the Sunne either rising, or setting. Other matters are related of this mountaine *Athos* more strange then the former, to wit, that it should in hight transcend the Region of the *raine*, and *wind*, which they would strive to confirme out of an old tradition; that the *ashes* heaped together on certaine Altars built on the top thereof were never blowne away, but remained in the same manner as they were left: to which may be added out of *Strabo*, that they who inhabit the top of this mountaine, can see the Sunne 3 houres before those who inhabit neare the sea: The like is reported by *Aristotle* of the Mountaine *Caucasus*, that for the extreame height, the top of it enjoys the Sun-beames a third part of the night; Little lesse is spoken by *Pliny* and *Solinus* of the mountaine *Cassius* in Sy-

ria, and by Pomponius Mela of the mountaine Cassius in *Arabia*; But how fabulous and incredulous these things are, Petrus Nonius and other Mathematicians haue sufficiently demonstrated out of the grounds of Geometry; more absurd by farre seemes that, which Eustathius reports of *Hercules pillars* celebrated by *Dionysius Perieges*, for their admirable height; whereas they are found not to exceed 100 *ells* making one furlong; a height according to *Strabo* not exceeding the *Egyptian Pyramides*, and comming short of certaine *Indian* trees neare the Riuer *Hyarotes*, whose *Meridian shadowes* reach 5 furlongs; These errors in the ancient might seeme veniall, had they not bin seconded by latter writers: Of the Mountain *Tenariffe* in the *Canaries*, *Scaliger* is bold to report out of other mens relations, that it riseth in height aboue 15 leagues, which make 60 miles; but *Petrinius* more bold then he, would haue it 70 miles; Little lesse is spoken of *Pico* amonst the *Azoris Insula*, and the Mountain *Andi* in *Peru*; But to confute these relations we will vse this argument; It is reported by the *Spanish* writers which haue spoken of this place, that the topps of these Mountaines scarce any one or two monethes in the yeare are free from *snow*: Now that *snow* should be ingendred aboue 60 or 70 miles aboue the ordinary plaine of the *Wnter* or *Earth*, is against the iudgment of our best *Astronomers*; because, as they haue obserued out of *Eratosthenes* measure, the heighest vapors seldome reach so farre, as 48 miles in height every way from the *Earth*. This argument may as well serue to confute these ancient opinions before mentioned, had they not bin so fabulous, as scarce to deserue any solide confutation.

3 The ordinary height of the Land aboue the Sea in diuerte places is more then the height of the highest Mountaines aboue the ordinary face of the Earth.

We haue probably shewed out of former grounds, that as the ordinary height of the Earth is answerable to the ordinary

nary depth of the Sea, so the *hilles* and *mountaines* in proportion answe to the *whirle-pooles* and *extraordinary gulphes* of the Sea: but it is to be imagined that the depth of the Sea in the maine Ocean, is farre more below the superficies of the Earth then those other *whirle-pooles* and *Holes* extend them-selues below that depth. But to proue this by a more sensible Argument we will compare the one with the other, so farre forth as *Mathematicians* by experience haue guessed; for it is found by *Mathematicall Instruments* (as we haue proued in the precedent Theoreme) that the highest *Mountaines* sel-dome or neuer mount vpward aboue ten furlongs, which is *an English mile*, and a *quarter*: but the hight of the Land in some places where appearre no such *hills*, is obserued to be much more: to proue which assertion, we can haue no fitter argument then the fresh *Springs* of *Riuers*; for it is manifest that all *Riuers* are higher at the *Spring* or *fontaine*, then at the place where they disburthen them-selues into the sea. Now although *water* is apt to slide away at any *Inequality*, yet it is most probable that in greater *riuers*, especially where the *waters* fall oftentimes with violence (as at the *Cataractes* of *Nile*) much *inquality* must be granted in the *Declivity* of the ground: supposing yet the *water* for every *mile* to gaine two *foot* in the *Declivity* of the ground, we shal find the hight ver-y neere to *equalize* the hight of the highest *mountaines*; although 2 *foot* in a *mile* is farre lesse then can be imagined in so great a *Riuer*: The *Riuer* which I take for an example shall be *Nelus*, which we shall obserue to runne about 50 *Degrees* from *South* to *North*, which resolued into *miles* will make 3000: accompting for every *mile* 2 *foot*, we shall haue 6000 *foot*, which will be neare these 10 furlongs, being a *mile* and $\frac{2}{3}$ *parts*: then allowing for these mighty *Cataractes* where the *water* falls with so great a violence, we must reckon a number of *feet* far greater then this measure; for every *mile* must the hight of land aboue the sea be much more then of the *mountaines*.

4. *Mountainous Regions are commonly colder then*

then other plaine Countries.

This Proposition is not absolutely to be vnderstoed without a limitation: for some plaine Countries neare the *Articke Pole*, may be colder then some hilly Regions neare the *Æquator*, in regard of other concurrent causes: but here we speake (as the *Logicians vse*) *cæteris paribus*; comparing two places either together like, or not much different, or at least in our vnderstanding, abstracting them from the mixture of all other considerarions: that this Theoreme is worthy credite, diuerte reasons stand in readines to iustifie: the first may be drawne from the cause of *heat* in Inferior Bodies, which is the reflexion of the *Sunne-beames*. Now that this *reflexion* is of more strength and validity in *plaine* then in *hilly* and *mountainous* Countries, is evident: first, because (as the *Optickes* teach) the *rayes* are more ioyned and combined in a *plaine*, then in a *convex* superficies; for howsoeuer the whole Earth be of it selfe *Sphericall*, yet the *convexity* being not sensible, by reason of the vastnes of the Circle, whereby the *convexity* is made lesse, it may *optically* be called a *plaine* superficies: Secondly, it is taught in the *Optickes*, that a *reflexion* is of more validity in an *aquall*, then in an *vneuen* & *ragged* superficies, such as is found in *Mountaines* and *vneuen* places. A second reason why *mountainous* Regions should exceed others in *cold*, may be the vicinity of them to the middle Region of the *Aire*; for of all the Regions (if we believe *Aristotle*) the *middle* is the *coldest*, as being more separate from the *Sunne* the *fountaine* of *heat*, and the *higher* Region, farther off from the *reflexion* of the *Sunne-beames*, then the *lower*: Now sith the parts of the Earth are affected with the quality of the *Aire*, it must needs stand with reason, that the more it shall approach to the *middle Region*, the more it must partake of it's quality. Thirdly, that this is consonant to observation, reasons are vrged by experiance of all Travellers, who report the Tops of *Mountaines* even in the midst of *Summer* to be couered ouer with *snow*, although situate vnder or neare the *Æquinotriall* Circle: Of this nature are the *Alpes* in *Italy*, the *Mountaines*

of the Moone in Africke, Andi in Peru, and Tenariffe in the Canaries. That snow should be an effect of cold, I need not labour to confirme. A fourth reason may be drawne from other effects of cold, or heat; for it is daily proued by experience, that such diseases as chiefly follow heat, especially the Pestilence in Egypt, and such plaine Countries, are wonderful prevalent, whereas hilly and rooke Countries by the benefit of Nature stand in little feare of such Inconveniences. Lastly, no greater argument can be drawne, then from the disposition of such men as inhabite such hilly Regions, who haue all the Symptomes of externall cold, and internall heat: Insomuch as Bodin seemes to make a Harmony and Consent betwixt the Northerne man and the Mountainist; the Southerne man & such as inhabite plaine countries, ascribing to the former externall cold, and internall heat: to the later externall heat, and internall cold. How farre this comparison will hold, we shall haue more occasion to discusse hereafter, when we come to the consideration of the Inhabitants.

5 Mountaines since the beginning of the world haue still decreased in their quantity, and so will continually decrease vntill the end.

This obseruation Blaueanus, I know not how truly, ascribes to his owne Invention: but to what Author soever we owe it, we must needs acknowledge a pleasant speculation, grounded on good reason. This Theoreme to demonstrate the better, we will first lay these groundes oftentimes before-mentioned. First (as appeares by testimony of holy Scripture) the figure of the Earth was in the beginning more perfectly Spherical, ouer-whelmed euery-where with the Waters. 2^{ly} That a separation was made by translocation of the parts of the Earth, in such manner as some places admitting of concavities, became the receptacle of the waters, other places whereon these parts of the Earth were heaped together, were made mountainous. 3 Hence will follow, that the Earth thus swelling vp in high mountaines, is out of his naturall site and position:

tion: & therfore according to the law of Nature, will endeavor by litle and litle to retурne to her former state and condition. Now that the Earth hath sensibly suffered such a change since the beginiang, it is easie to shew out of experiments: the causes we shall find to be the *water*, aswell of the *Rain* as *Riuers*, which we shall demonstrate by these Reasons: 1 We see *Riuers* by litle and litle continually to fret and eat out the feet of *mountaines*, whence the parts thus fretted through, by cōtinuall falling downe weare out the mountaines, and fill vp the lower places in the valleyes, making the one to encrease, as the other to decrease, & the whole Earth to approach nearer to a *Spherical* figure then before; which seemes to be warranted by a place in *Job*. 14, where he saith to God; *The mountaine falling, commeth to nought, & the rocke is remoued out of his place. The waters weare the stones, thou washest away the things which grow out of the dust of the earth.* From these *Riuers* in the valleyes continually eating through the parts of the Earth, at the fecte of mountaines are caused those slow but great *Ruines* called *Labina, à lambenda*, by which sometimes whole Townes and Villages haue bin cast into the next great *Riuer*. 2 To proue that *Raine water* challengeth a part in this diminution of mountaines, we may shew by the like experience: we see plainly that *Raine-water* daily washes downe from the *Toppes* of mountaines some parts of the Earth; whence it comes to passe that the highest mountaines are harder and more rocky then others, as being more able to resist this violence of the water. Hence also it happens that old buildings being erected in the fides of mountaines, haue their foundations after a time vncouered, and are much subiect to *Ruines*: an instance whereof may be giuen out of the *Romane Capitoll*, whose foundation (according to the relation of *George Agricola*) appeares now plainly aboue the ground, which without question was heretofore deepe rooted in the Earth. In *Plaines* and *vallyes* we find all things to happen contrarywise, to wit, that ali places in regard of their superficies are raised much higher then they were in times past. The reason whereof may easily be giuen out of the great quantity of the Earth, carried by the washing

of the Raine from the Tops of mountaines into the vallyes: whence we may perceiue old houses, heretofore fairely built, to be now almost buried vnder ground, and their windowes heretofore set at a reasonable hight, now growne euen with the pauement: so some write of the Triumphall Arch of *Septimus* at the foot of the Capitol Mountaine in *Rome*, now almost couered with Earth, insomuch as they are inforced to ascend down into it by as many staires as formerly they were vled to ascend. In like sort we see in old Monasteries & Religious houses, their lower roomes, windowes, & doores, very far couched vnder ground, of which great incóvenience we cannot suspect the Architects iudgment, but rather our fore-mentioned cause: from this burying of parts of some houses vnder ground, it may be gathered, that the farther they are vnder ground, so much ancienter they are: as we may obserue heere with vs in *Oxford*, that our most ancient Colledges haue the windowes of their lower roomes, somewhere altogether choaked vp with Earth without, or at least halfe way, in somuch as the floore within, is found to be farre inferiour in height to the street without: This is also confirmed by Architects, who in digging vp old foundations, before they came to firme ground whereon to erect a building, are enforced first to remoue away the *Rubbish* or (as they terme it) the *Made-ground*, wherein oftentimes they find *Wood*, *Iron-Instruments*, *old coine*, with diuers other Trash of this Nature. An instance we haue in some of the lower places in *Somerset-shire*, where some vpon occasion digging the Earth somewhat deep, haue found great *Okes* turned topsy turvy with their Roots vpwards. To coniecture with some, that this was caused by *Noah's Floud*, seemes to be very improbable: 1 because as we haue formerly shewed in this Chapter, the Water in the *Deluge* could not haue so violent a motion to procure such an alteration in the parts of the Earth. 2 It cannot so well be imagined how such Trees should remaine so long a time without putrefaction: wherefore we cannot well easit it on any other cause, then the addition of the earthly parts, brought by raine from the mountaines into the vallyes: and

so by some *Land-flood* which partakes much of slimy and earthly matter dispersed abroad vpon the land about. Now on the contrary part we find in few places of mountaines such made-ground which hath before bin moued. This will also appeare out of the industry of our *Low-countrymen*, who by baying vp the Riuers into certaine Artificiall Channels, the ground about hath bin much raised: where on the contrary side the forcing of the water into higher places, ofteentimes is found to fret through the Earth, and make it lower. What we haue spoken of the effects of *Riuers* and *Raine* in diminishing the greatness of the *mountaines* and exalting of the vallyes, we may in some sort find in the sea. For the botome of the Sea being lower then the Earth, & many great Riuers continually running from the Earth into it; it is manifest that there is carried in their current a great quantity of earth, insomuch as by the heaping of sand and earthy rubbish, the mouthes of great Riuers are in time choaked vp, and commodious hauens spoyled & remoued farther into the land: of which alternall transmutation of the Sea & Land we shall speake hereafter: & for present instance need to goe no farther then diuerse Townes in *Devon*, which (according to the Relation of ancient men) haue heretofore bin faire hauens, able to receiue great ships, to which notwithstanding at this time a small boat cannot arriue except in a full Tide. The like whereof is reported by *Aristotle*,¹ of a place in *Egypt* called *Delta*, made by the heaping vp of sand & slime, brought by *Nilus* from the *Ethiopian* mountaines,² of *Ammania Regio*, which in times past being Sea, through the slime convayed in the Riuers, became afterwards as a standing poole, which in processe of time waxed dry, and ioyned it selfe to the Continent.³ Of *Moris Palus*, that the dry land environing it round, is so much encreased, that ships of that burthen cannot arriue, which could in times past within 60 yeares before; which is also in some sort testified by *Polybius*.⁴ The like is related of *Bosporus Thracius*, and many other places recorded by *Pliny*, of which we shall speake hereafter. From these obseruations *Blancanus* would inferrre these conjectaries: ¹ That the Earth was not from the

beginning endowed with mountaines: 2 That it should not so continue till the end of the world ; and vntill the Fire (whereof the Scripture speakes) should prevent it, the whiche Earth should in the end be ouerwhelmed with waters, as in the beginning, and so be made void of habitation, but on such coniectures I dare not too boldly vnterprise, being speculations built on no sufficient grounds : All which can hence warrantably be collected is expressed in our former Theoreme.

- 2 Of the Figurature of Countries in *Mountaines, Valleyes, and Plaines*, we haue spoken: It is requisite here we speake somewhat of *Woods* and *Champian Countries*.
- 3 A *Wood* is a Region or space of Land beset with trees. A *Champian Region* is a space of Land either altogether voide, or scarce furnished with trees.

Some Criticks here curiously distinguish in Latine, betwixt *Sylva, Lucus, & Nemus*: by *Sylva* vnderstanding a space beset with trees, ordained to be cut downe; but *Lucus* was a place where trees were not ordained to be cut downe, but reserved sacred: For in such groves they did anciently use to offer sacrifice, as may appeare by diuerse places out of the *Olde Testament*, where the Heathenish manner of worshipping was forbidden, and sometimes reproved in the Kings of *Iuda* and *Israæl*: That which the Latines call *Nemus*, is a Grove or Wood ordained onely for pleasure and recreation: but the discussing of these busynesses rather belong to a *Grammian* then a *Geographer*; who takes little notice but of those matters which most principally and remarkable belong to any Region; wherefore omitting other curiosities, we haue distinguished onely betwene a *woody* and a *champian Country*; whereof (as we have defined) one is beset with a multitude of trees; the other with few or none. What concernes a *Geographer*,

phere to obserue in those matters, shall generally be comprised
in this Theorema.

I Woods in these dayes are not so frequent, nor
so great as in ancient times.

We cannot imagine otherwise then that the Earth soone
vpon the flood, bearing in her wombe the seeds of all vege-
tals, being inwardly moistned, and outwardly comforted
with Heat, should presently abound with plants of all sorts;
insomuch as in a short time each thing propagating it selfe by
communication of his own seeds, the whole Earth was ouer-
growne as one forrest: but afterwards as man began to spread
and multiply on the face of the Earth, these Woods and Thic-
kets began to suffer chastisement vnder the hand of laborious
husbandry: For first to open a passage from one place vnto
another, and that some parcels of ground should as pastures
be diuided from ~~woody~~ acres, it was necessary that this great
plenty of trees should suffer a decrease: yet little had this bin
noted in so vast a store, had not the invention of building of
houses by little & little turned great forrests into Cities; which
for the most part owed not only their first originall, but also
their daily reparation to Trees and Timber: but aboue all the
greatest deuouer of woods and forrests is fire, an element fed
and nourished almost of no other matter. For to let passe the
ordinary vse of fire in euery house and family, which in so infi-
nite a multitude of people, in so many yeares since the Flood,
must require an extraordinary proportion of wood and fuel,
how many Arts haue bin since invented, depending only vpon
this Element? we will goe no farther then the Art of *Lique-
faction, fying of gold and other mettals*, found out in the
bowels of the Earth, wherein the couetousnes of men hath
bin as vnsatiable as the fire. To this which we haue said, may
probably be opposed two things: first the power and inclina-
tion of euery Creature to multiply and propagate it selfe. Se-
condly, the industry of mankind in secondeing that inclination:
Whence it may be conjectured that great woods should by
durance increase to a greater quantity: for the former, no man

will deny, but that plants and trees left to themselues, will commonly propagate their kind: neuerthelesse it cannot prevaile so much as the other, which procure the decrease: first because the Earth being dryer now, then soone vpon the *Flood*, cannot so much further the growth of vegetals as then it did: Secondly, because (as we haue said) this growth in a populous Country, cannot be so great as the diminution, since few or no houses can want so necessary an Element as fire. To the second we answere that man's industry hath done somewhat in plantation of groues, and such like: but how little is this in comparison of the huge and vast forrests in time by man wasted and consumed. We shall read of *Germany*, that in the time of *Cesar* it seemed a wilde Country, hauing many great woods and forrests, but few Cities: but now the case being altered, we shall find the *Cities* both in number and greatness increased, and the *Woods* diminished. Two instances may suffice, the one of the Forrest of *Ardenna* in *Lutzenburg*, accompted in *Cesar's* time 500 miles ouer, now scarce 50. The other of *Sylva Hyrcinia*, which heretofore (if we beleue Histories) reached so farre as a man could trauaile in 60 dayes; but now is made the onely limit or bound dividing *Bohemia* from the rest of *Germany*. The like may be obserued almost of euery other Country reduced to ciuility.

2. *Places moderately situated towards the north or south Pole abound more in Woods then neare the Aequator.*

This situation we understand to comprehend almost all the *temperat* Zone, reaching either way so farre as 60 degrees or there about. The demonstration of this Theoreme depends of these two fomentes of all plants, *Heat & Moisture*; both which concurie, not only to the abundance and fertilitie, but also to the greatness of all plants; for it is most certaine that wheresoeuer these two vitall succours are wanting, or deficient, there must be a great scarcity of *trees, fruits, herbage, & such like*: This is the cause why the Regions farre North neare about

about the Pole, beyond 60 degrees, haue not onely scarcity of trees, but haue them such as are, of a farre smaller quantity then other Regions, lyng more temperate: For the inter-nall & naturall heat is almost extinguished, with the extremity of cold, and the moisture(as it were)dried vp by the frosty disposition of the Region. To this cause may we ascribe, that which Geographers haue deliuered concerning *Iland*. that for want of *Timber* they couer their houses with *fish bones*, digging out houses in the sides of Rockes and mounaines. Moreouer that the meere defect of moisture may cause a scarcity of growth, may be proved by many places: 1 because temperate Regions, which are *mountanous* and lying higher, produce trees of small length; Bodin testifies as a thing very remarkeable, that he hath obserued oakes in *France* not exceeding 3 or 4 feet. But this is no great wonder with vs in *England*: sith in the dry and barren plaines about *Salisbury* there are many examples not much different: All which, we can ascribe to no other cause then the want of moisture. On the other side as great or greater a defect of heat & moisture, is found neere the *Æquatour*, by reason of the external heat of the *Sunne*; which in all plants and vegetalls, not only evaportates the moisture, and by consequence causeth drowth; but by the extraction of Internal heat, leaueth a greater cold behind, correspondent to that humour in a man, which we call *Melancholy* and *choler-adjist*: But this extremity of heat causing this defect of inter-nall heat & moisture, we place not directly vnder the *Æquinoctiall*; because we haue shewed it to be more temperat: but rather vnder the *Tropickes*, which by experience are found scorched with great heat. How subiect these places vnder the *Tropickes* are to this sterility, we need goe no farther then *Libia* and *Numidia* to confirme: Places by the report of travailers, indigent not only of *woods* and *trees*, but almost of all vitall succours. Whereas the *woods* & *forrefts* dispersed almost in every region of *Europe*, and the more temperat parts of *Asia*, are celebrated of all writers. Yet whereas we haue defined the cheifest places for the growth of *woods* to be toward the North, so farre as 60 degrees.

grees or there abouts; we cannot warrant this as an absolute generall observation; because some places lying very low, & subiect to much moisture, though situat more Southerly, may enjoy this proportion, as we haue formerly shewed of *trees* neare the River *Huartis* recorded by *Strabo*, to haue their noone shadowes of 5 furlongs, as also of certaine trees in *America* neere *Rio Negro*, wherein (as *Peter Martyr* writes) a King dwelt with all his family. But these places howsoever situat towards the *South* are (as *Geographers* deliuer vnto vs) most times of the yeare overwhelmed with Water, consisting all of *marsh grounds*: yet these few instances drawne from the particular disposition of the Earth it selfe, cannot much impeach our proposition, which takes notice only of the situatiou of the Earth, in respect of the cardinall points of *North* and *South*, compared with the heauens.

CHAP. XI.

- 1 **I**therto haue we treated of the *Absolute adjuncts* of the land; we are now to speake of the *Relative*, which imply a respect of the *land* to the *sea*.
- 2 From this Termination of the land with the sea, there ariseth a two fold distinction: The first is of the land into *Continent* and *Illands*.
- 3 A *Continent* is a great quantity of land consisting of many kingdomes and Regions, not divided by Water, the one from the other:

other: An *Illand* is a parcell of land compassed round with the sea.

An *Illand* is called in Latin *Insula, quasi in salo*; because it stands in the sea; some would haue it in English termed an *Illand*, as it were, *Eye of the land*: But this derivation seemes affected & not naturall: it might seeme more naturally to be derived from the French *L' Isle*. But we will not dispute of the name: It is enough to vnderstand, that an *Illand* is a portion of the habitable Earth, every where environed with the sea, or at least with some great Riuier: but this last sense seemes more improper then the other; yet oftentimes vsed, as *Memroe* in *Africa* an *Illand* of *Nilus*, and the *Illand* of *Eely* in *England*. To this is opposed the *Continent*, as that land, which being not divided and separated by the sea, containes in it many empires and kingdomes, as *Europe, Asia, Africk, America*; all which, as farre as we can yet gather, are vntited and ioyned together, in one continuall land; *Strabo* affirmes out of this in his 1. booke and first chapter of *Geographie*, that the whole Earth is one *Illand*; sith all these knowne parts of the Earth, are compassed about with the sea on euery side: But this opinion cannot stand with reason, or moderne obseruation: First because this acception is too large; forasmuch as an *Illand* is properly taken for a smaller part, divided from the rest of the land, and opposed to the *continent*; whereas if this sense were admitted, the distinction of land into *Continent* and *Illand* would haue no place, or at least the same in a diuise respect, might be called a *continent* and an *Illand*. But it is plaine that *Ilands* were alwayes opposed to the *continent*, to which, although separat by Water, they were supposed to belong, as to *Europe, Asia, Africk, America, or Magellanica*, or some other as *Geographers* haue reduced them. Secondly, because it was a cold conjecture to thinke the whole world to consist only of those parts, found out in *Strabo's* time: For besides the two parts of *America* since that time discouered by *Columbus*, another great portion is since that time found out in the south, by the conjecture of *Ferdinando de*

Ques.

Quir, comming neere the quantity of Europe, Asia, & Africa. Which howsocuer it be round enuironed with sea, and therefore might seeme an Iland, yet in respect of the greatness of it, and the many regions and kingdomes it containes, it may well be reputed a continent: To which many lesser Ilands belong.

I. It is probable that Ilands were not from the first creation, but were made afterwards either by the vniuersall deluge, or some other violence of the Water.

It hath bin the opinion of diverse learned men, that Ilands were not only before the Flood, but from the first creation of the world: because they seeme no lesse to make for the ornament of the Earth, then diuers Lakes and Riuers dispersed on the Land. But this argument seemes very weake: first because a greater ornament seemes to consist in vniformity then confusion; besides, the ornament must not be measured by our phantasie, but God's Almighty pleasure and will expressed in his own workmanship: and that he created Ilands in the begining, is the thing in question. That Ilands were not from the Creation, many probable reasons are alleged: First from the words in the 1 of Genesis: *Dixit verò Deus, congregentur aqua que sub cœlo sunt, in locum unum, & appareat arida: & factum est ita; & vocavit Deus aridam, terram;* congregatio-
neq; Aquarum appellavit maria. By which may be collected, that the waters were gathered together in their own place, by themselues, and therefore had no such intercourse betwixt Land and Land as now they haue, admitting Ilands: wherefore it is more probable, that such Ilands as now appeare were either caused by that *Vniversall Deluge* of Noah, or by some other Accident: for it is most certaine that the Sea on the Land some-where gaines, and other-where in recompence of it, it loseth againe: as may appeare by the 14 of Genesis; where it is said of the comming together of certaine Kings: *Hi omnes convenierunt in vallem Sylvestrem, quannic est mare*

salis

salis: out of which it is evident that that parcell of ground which was a woody place in the time of *Abraham*, was before the time of *Moses* become the *Salt Sea*. Many examples of the like are giuen vs by *Pliny* in his *Naturall History*, which we shall hane occasion to vrge hereafter: And therefore it is no hard thing to belieue, that since the first beginning of the world all Islands might be produced in this sort. Another argument by which they would establish this opinion, is that we see almost all Islands of the Earth not onely inhabited of mankind, but also furnished with diuerse kindes of Beasts, some tame, some wilde, some wholesome, some venomous, some vſefull, some altogether vnprofitable. Now it seemes verily vnlikely that men being in elder times, and now also in most places of the Earth, altogether vnskilfull in the Art of Navigation, should venture so farre on the maine Ocean, to people Countries so far distant; sith at this day, wherein Navigation is arrived at a great perfection, hauing the helps both of the *Charts* and *Cerapasse*, altogether vnkowne vnto the ancients, we see most Nations very scrupulous in searching out farreremote Countryes. But admit this were ouercome by man's Industrie, which no doubt is much increased by Necesity; yet cannot it be very probable, that so many sundry kindes of beasts should in this sort be transported: for howsoeuer we conjecture concerning such beasts as necessarily serue for man's sustenance; yet seemes it hard to thinke that man should be so improvident and envious to the place of his own Habitation as to transport ravenous, venomous, vnwholesome, & vnprofitable creatures: for by no other meanes but by transportation can such beasts be imagined to be brought into Islands: For the first originall of all creatures in the Creation was in or neare *Paradice*, which we shall proue to haue bin in the Continent of *Asia*; the second *seminary* was in the *Arke*, which by the testimony of the Scriptures was first disburthened in the same Continent. How from hence they should spread themselues into Islands, is the doubt. Imposſible it seemes they should swimme so farre; for what Creature will venture it selfe on the maine Ocean being by a naturall

instinct fearefull of death, and carefull of his own preseruation: Whence it is more likely to imagine, that these parcels of land being first furnished with such creatures, were afterwards by the violence of the flood, or some other like Accident, come off from the maine Continent, retaining still such Creatures as it had before. But here *S. Augustine* seemes to avoide this Argument two wayes: It is not (faith he) incredibile, that wild and sauage beasts might be transported from one Country to another by Sea: either by *Men* for the delight of Hunting; or else by the helpe of *Angels* by God's Commandement, or at least permission. This answer seemes very probable aswell for it selfe, supposing nothing impossible impossible to Almighty God, as also for the authority of the *Author*. But with all reverence to the *Author*, whom all the *Christian* Churches are bound to honour, this assertion is not so strongly fortified to enforce assent. And first it is not verely likely that pleasure with men should so farre oversway the generall weale and profit, as to transport so many ravenous and hurtfull beasts, for meere hunting sports and recreation. Secondly, the chace of some, as *Lions*, *Leopards*, and such like, hath more danger in it then sport or delight; and if so be these were conveyed ouer Sea for such ends, yet it is very probable, they would keepe them rather close and imprisoned to serue occasion, then to let them loose & free for farther propagation. Finally whereas he ascribes the transportation of them to the ministry of Angels; no man can deny but this may be possible; because by the permission of Almighty God they might effect greater matters. Yet seemes this not so likely as the other, because we find that in the generall preseruation of all creatures in the Arke, he vsed the ordinary helpe of Naturall meanes, altho' directed and assisted by a divine power: And if God effected greater matters in this sort, why may we not believe it of things of lesser moment and necessity? But of this we haue spoken before. Another reason for our opinion that Islands were not before the flood, or at least from the Creation, is vrged by *Verstegan* a late Writer in this manner: There is nothing broken (faith he) that hath not bin whole:

whole; which he sets downe as an infallible principle: for howbeit Nature doth sometimes agaist her own intent commit some errors, insomuch as the things formed haue either too much, or too little; yet bringeth she forth nothing broken or disseuered; but such as it is, it is alwayes whole, and not broken, except afterwards by some accident. And if *Nature*, the hand-made of God, never misseith this perfection, much more ought we to belieue that *God* the Father of *Nature* in the first Creation left no part thereof broken and vpperfet. But every man may see by ordinary obseruation, that the *Cliffs* and *bsunds* of the Sea (as not being by God in the creation so formed) seeme not onely seuered and broken, but (as it were) cut straight and steep downe from the top to the botome, not stooping or declining by degrees; as we see in *Inland Hills* in their descent vnto the vallyes. The forceable breach of the land (as we pretend) by the Sea fretting through some narrow place, seemes the more to be confirmed in that we find it not steep towards the Land, where the Land declines by a sloping descent as in other places; but rather towards the Sea in such sort, as both the sides of a narrow and streite Sea oftentimes in the nature of the soile, and conformity of figure, seeme to answere one the other, only shewing the want of substance betwixt them which is lost. It may hence be objected that many other hills and rocky places of Inland Countryes seeme in like manner as broken & steep downe as these *cliffs* bounding the Ocean; as also that the *cliffs* towards the Sea are broken higher vp then any wayes the Sea could be imagined to ascend. To this we answere, first that *rocks* on the dry land in any times seene broken, when indeed they are not, being by Nature fashioned craggie and vneuen: Secondly, whereas *Hills* in Inland countries seeme broken, this might proceede heretofore by *Earthquakes* which haue oftentimes bin obserued to produce such effects, as it hath lately beeene knowne to doe in a Town called *Pleurs* in the *Grisons* Countrey neare the *Alpes*: and for the appearance of such breaches in the tops of *cliffs* aboue the ascent of the waters, it might be caused by the violence of the Sea waues, fretting and eating

out the sides of them beneath the bottome; whence it happens that the higher part for want of vnder-propping must needs fall and breake off from the other. This Argument of our said Author is by him backt with another, drawne from the name of a *cliff*, which in our ancient language is drawne from cleauing or breaking off: which appellation is neuer given to our Inland Hills, but only to such as terminate & compasse in the Sea. These reasons make the matter seeme probable; yet condemne I not the other as absurd, because it may probably be defended, and backt with the authority of many graue Authors.

4 A second Distinction ariseth out of the termination of the Land with the Sea: For either it is *vniforme* or *various*.

5 An *vniforme* termination I call that which without any notable difference inclines more to euuenesse and Regularity.

It is manifest that the Sea-waues working on the Land *violentely*, and not *naturally*, seldom or neuer so bound and compasse the Land, as to reduce it to a regular and perfect figure. But yet because in some places it comes somewhat neare to such a figure, somewhere it is very farre off; we thought it fit to insert this distinction. This inclination to a Regular figure is some-where square, consisting of *Right-lines*, some-where *circular*; an example of the former we haue in *Spaine*, which on the *North* side, & the *West* is bounded more streitly, comming neare a *right-line*: of the other in *Africke*, whose *North-West* side from the *Mediterranea* streits to *Guinea* seemes in some sort circular.

6 A *various* Termination is that wherein the bounds are crooked, and as it were indented with crekes and turnings. Heere three things

things are remarkeable. 1. *Peninsula, Istmus, and Promontorium.*

7 A *Peninsula* is a part of land euery where environed with the sea, excepting in one part, where it is knit vnto the maine land: An *Istmus* is a narrow land betwixt two seas: A *Promontorie* is a high mountaine bending it selfe into the sea: the head whereof is called a *Cape*.

These three are remarkeable accidents growing out of the Termination of the land with the sea, and belonging as well to continents as Ilands. The first we call *Peninsula, quasi penae Insula*, termed of the *Gracians Chersonesus*, although I find this name oftner giuen to the *Istmus* then the *Peninsula*. Amongst the *Peninsulas* the most famous are *Africa, Scandia, Taurica Chersonesus, Peloponnesus, and America Pernana*. That little parcell of land which joynes this *Peninsula* with the maine land, we call an *Istmus*, which is a narrow neck of land betwixt two seas, ioyning two Continents; such as are *Istmus Corinthiacus* and *Istmus Cimbricus*: more famous are those two narrow lands, whereof the one lieth betwixt *Peruana*, and *Mexico* in *America*, the other dividing *Africk* from *Asia*. A *Promontorie* is a great mountaine stretching it selfe farre into the sea: whose extremity is called a *Cape* or head, of which the most remarkeable are the *Cape of good hope* in *Africk*, 2. The *Cape of St. Vincent* in *Portugall*, 3. The *Cape of Corsary* in *Asia*. 4. The *Cape de la victoria* in *America*. Our obseruation concerning this distinction shall be compri- sed in this Theoreme.

1. *Peninsula's by the violence of the sea fretting through the Istmus, haue oftentimes*

A a* 3 bin

bin turned into Ilands: and contrariwise sometimes Peninsulas by diminution of the sea made of Ilands.

This proposition is not hard to proue, if any credit ought to be giuen to ancient writers: for it is commonly related, that Sicily was heeretofore ioyned to Italy, Cyprus to Syria, Eubea, wch Boeotia, Besbieum with Bythinia; all which at this day are Ilands separated and diuided from the continent. The like hath bin conjectured of our Britanny, which some imagined heeretofore to haue bin ioyned with the continent of France, about Dover and Calais: as may seeme probably to be gathered out of the correspondency of the Cliffs (whereof we haue spoken in this chapter before) the agreement of the soile, the smallnes of the distance, and many more arguments remembred by vs else-where. Also it hath bin obserued on the otherside, that the sea in some places leauing his ancient bounds, hath ioyned some Ilands to the land, making Peninsulas of Ilands. In this sort if we belieue antiquity was Antissa ioyned to Lesbos, Zepharium to Haliacarnassus, Ethusa to Mindus, Promiscon to Miletum, Narthycusa to the Promontory of Parthenitus: In these antiquities it behoues euery man to iudge without partiallity, according to reason, not ascribing too much to fabulous narrations, wherein those ages did abound, neither yet shewing himselfe too incredulous: Forasmuch as we cannot charge these Authors with any manifest absurdity. The speciall and particular arguments by which we should establish our assertion, we must according to the rules of method referre to the speciall part, where we shall treat of speciaall countries.

C H A P. XII.

1  F the perpetuall Accidents of the land, we haue spoken somewhat: it remaines in this place we treat of the casuall.

2 The casuall *I* call such as happen not ordinarily at all times: such as are *Inyndations* and *Earth-quakes*.

3 An *Inundation* is an ouerwhelming of the land by Water.

Howsoeuer it be certaine out of holy Scriptures, that Gd hath set the sea his certaine bounds and limits, which it cannot passe: yet the same God sometimes to shew his speciall judgment on some place or age, hath extraordinarily permitted the sea sometimes to breake his appointed limits, and inuade the Inuasion of the land. This we call a *deluge* or *Invdation*. The inundations which ever haue bin obserued on the Earth, are of two sorts, either *vniuersall* or *particular*: An *vniuersall* is that whereby the whole face of the Earth is couered with water; whereof we haue only two examples: The first was in the first creation of the world, when (as we read in the Scriptures) the whole face of the Earth was round inuoloped with Water, which couered the tops of the highest mountaines, till such time as God by a supernaturall hand, made a separation of the Waters from the dry land: But this is improperly call'd an *Invdation*, because, the same properly taken implies as much as an ouer-flowing of that which was dry land before: The second (as we read in Gene-

(s)happened in the time of *Noah*, when God for the sin of man, drowned the whole world, breaking open the cataracts of heauen, and loosing the springs of the deep. Particular inundations are such, as are not ouer the whole Earth, but in some particular places or regions; Such a deluge (according to *Genesbrardus*) happened in the time of *Enos*, wherein a third part of the Earth was drowned. The like is spoken of *Ogyges* King of *Athens*, that in his time happened a very great *Inundation*, which drowned all the confines and coasts of *Attica* & *Achaia* even to the *Aegean sea*: In which time it was thought that *Buras* & *Helice* Cities of *Achaia*, were swallowed vp; whereof *Ovid* in his *Metamorphosis*, speaks thus.

*Si queras Helicen & Buran Achaidos urbes
Invenies sub aquis:*

Buras and Helice on Achaian ground

Are sought in vaine, but vnder leas are found.

As famous was the *Invndation* of *Theffaly* in *Deucalions* time mentioned not only by profane writers and Poets, but also by *St. Angustin*, *Ierom*, and *Eusebius*, which would haue it to happen in the time of *Cranaus*, who next after *Cecrops* governed *Athens*. This invadation was exceeding great, extending it selfe not only ouer all *Theffaly* and the regions adioyning westward, but ouerwhelmed the greatest part of *Italy*. The same or other happening neere the same time, oppressed *Egypt*, if *Eusebius* may obtaine credit. Hence some would haue the people of *Italy* to haue bin called *Vmbrii* (as *Pliny* & *Solinus* report) *quia ab imbris diluvij superfluisserunt*. But this *Etymologie* seemes too farre fetcht. There are also two other notable *Invndations* mentioned by ancient writers, which fell out in *Egypt* from the Riuers *Nilus*; whereof the first covered all the neither *Egypt*, which was subiect to *Prometheus*, and hence (as *Natalis Comes* obserues) was the fable drawne of the vulture lighting on *Prometheus* liner, afterwards slaine by *Hercules*. For (as *Diodorus Siculus* obserues) the Riuers *Nilus* for the switnes of his course was in ancient time called an *Eagle*. This Riuer afterwards did *Hercules* by his

his great skill and judgment sticthen and bound , reducing it into narrow channels: whence some Greek Poëts turning *Hercules* labours into *fables*, faigned that *Hercules* slew the *Eagle* which fed on *Prometheus* brest , meaning that he deliuered *Prometheus* out of that sorrow and losse which he and his people sustained by that *Inundation*. The secound of these *Ægyptian* floods happened about *Pharus* in *Ægypt*, where *Alexander* the great built *Alexandria*. To these may be added many more of lesser momente, as well in ancient times as in our dayes: As that of *Belgia* in some parts mentioned before, on another occasion; and not many yearees since in some parts of *Somersetshire* with vs in *Britannie*.

I *No vniuersall Inundation of the Earth can be Naturall; The other may depend on some Naturall causes.*

Of the causes of *Inundations* many disputes haue beeene amoungst *Naturall Philosophers*: some haue trusted so farre to *Nature*, that they haue ascribed not only particular *Inundations*, but that *vniuersall Deluge* in the time of *Noah* to second causes: of this opinion was *Heericus Mecklenfis* a Schollar of *Albertus Magnus* , who in his *Commentaries* vpon the *greatest Coniunctions of Albusazar*, obserued that before *Noah's* flood, chanced a conjunction of *Jupiter* and *Saturne* in the last degree of *Cancer* , against the constellation since termed *Argo's ship*: out of which he wou'd needs collect, that the flood of *Noah* might haue bin fore-showne; because *Cancer* is a *watry signe*, and the house of the *Moone* being *misfisile* of the *Sea*, and all *moist* bodies according to *Astrologie*: which opinion was afterwards confirmed by *Petrus de Alliaco*, who affirmes in his *Comment vpon Genesis* , that although *Noah* did well know this flood by diuine *Reuelation*; yet this conjunction being so notable , he could not be ignorant of the causes thereof; for those were not only signes, but also apparent causes by vertue received from the first cause, which is *God him selfe*. Further to confirme this assertion he would haue *Moses* by the *cataracts of Heauen*, to haue meant the

the great & watry coniunction of the Planets. A reason where-
of he seemes to alleage , because it is likely that God would
shew some signe in the Heauens , by which all men might be
warned to so. sake their wicked courses. But notwithstanding
this curious opinion, I rather cleave to those which think this
deluge to be merely *supernaturall*, which I am induced to be-
lieue for diuers causes vrged by worthy writer. First, because
this is set downe in *holy Scripture* for a chiefe token or marke
of *Noah's* extraordinary *faith* and *dependance* vpon God's
promises: which had bin much diminished , and of small mo-
ment, had it any way bin grounded on the fore-sight of se-
cond causes. For this was no more then might have bin discov-
ered to the rest of the wicked worldlings , who no doubt
would in some sort haue prouided for their safety , had they
received any firme perswasion of this dreadfull *deluge*. To
which others add a second reason, that second causes of them-
selues, without any change or alteration, are not able to pro-
duce such an admirable effect as the drowning of the whole
World: for it is not convenient (say they) that *God* the Au-
thor of *Nature* should so *dispose* and *direct* the secona causes,
that they might of themselues be able to invert the order of
the *Vniuerse*, and ouer-whelme the whole Earth, which he
gauë man for his habitation. But this reason is thought ve y.
weake, forasmuch as it seemeth to imply a new creation; The
conceit of a new Creation is pronounced by a learned
Countryman of ours, both *unlearned* and *foolish*: for whereas
it is written (saith he) that the fountaines of the deepe were
broken open, it cannot otherwise be vnderstood, the 1 that the
waters forsooke the very bowels of the Earth, and all what-
soeuer therein was dispersed made an eiuption through the
face of the Earth. Now if we compare the hight of the waters
in this deluge aboue the highest mountaines, being onely 15
cubits, with the *depth* of the *semi-diameter* of the Earth to the
Center, we shall not find it impossible, answering reason with
reason, that all these waters dispersed vnder the Earth, should
so far extend as to drown the whole Earth: for the *semi-dia-
meter* of the Earth (as *Astronomers* teach) is not aboue 3500
miles,

miles, wherein the waters contained and dispersed, may be sufficient for the hight of the greatest mountaines, which never attaine 30 miles vpright: whereas this distance of 30 miles is found in the depth of the Earth 116 times. Secondly the extension of the Ayre being exceeding great, it might please God to condensate and thicken a great part thereof, which might concurre to this Inundation. We willingly assent to the worthy Author, that this Inundation might be performed without any new creation: Notwithstanding we cannot hence collect that it was *Naturall*. But to compose the difference the better, and to shew how far: e. Nature had a hand in this admirable effect, we will thus distinguish: that an effect may be called *Naturall* two manner of wayes: First in regard of the causes themselves: Secondly in respect of the *Direction* and *Aplication* of the causes. If we consider the mere *secondary* and *instrumentall* causes, we might call this effect *Naturall*, because it was partly performed by their helpe and concurrence. But if we consider the *mutuall application and coniunction* of these second causes together with the first cause, which extraordinarily set them awoke, we must needs acknowledge it to be *supernaturall*. For other particular Inundations in particular Regions we may more safely terme them *Naturall*, as directed and stirred vp by *second causes*, working no otherwise, then according to their own *naturall disposition*. Two causes concurring tog: other, are here most notable, wherof the first is the great *coniunction* of many *Planets* working on the water their proper subiect: the other the *weakenes* of the *bounds* and *banches* restraining the water, which by processe of time weare out and suffer breaches: both these causes sometimes concurring together, cause an Inundation: which assertion we may lawfully accept, but with this caution, that Almighty God working by *second causes*, neuerthelesse directs them oftentimes to *supernatural* and *extraordinary* ends.

2 Particular alterations haue happened to
Bounds of Regions by Particular Inunda-
tions.

Howsoeuer some inundation haue not continued long, but after a small time left the Earth to her own possession; yet others haue bin of such violence, as they haue bin found to haue fretted away, or added, and so altered the bounds and limits of places: which besides diuerte examples produced by vs, in our former chapter, Aristotle seemes to acknowledge in the 1 booke of his *Meteors*, the 14 Chapter, where he saith, that by such Accidents sometimes the *Continent* and firme land is turned into the *Sea*, and other-where the *Sea* hath resigned places to the *Land*: for sith the agitation or moving of the water depends ordinarily vpon the vertue of heauenly bodies, if it should happen that tho' starres shoulde meet in coniunction, which are most forceable and effectuall for stirring vp of tempests and flouds, the *Sea* is knowne to rage beyond measure, either leauing her ancient bounds, or else vlrping new. By this meanes (as we haue shewed in the former Chapter) some *Ilands* haue bin ioyned to the *Land*, & some *Peninsula*'s separated from the *Land*, and made *Ilands*: some-where the *Sea* hath bin obserued for a great space to leaue the *Land* naked, as *Varistegan* coniectures of the most part of *Belgia*, which he sayes, was in ancient time couered with water; which besides many other arguments he labours to prove out of the multitude of fish-shells, and fish-bones, found every-where farre vnder ground about *Holland*, and the coasts thereabouts, which being digged vp in such abundance, and from such depths, could not (saith he) proceed from any other cause then the *Sea*, which couered the whole Country, and strewed it with fishes. Lastly, that the *Sea* might seeme as well to get as loose, she hath shewed her power in taking away and swallowing vp some Regions and Cities, which before were extant: Such fortune had *Pyrha* and *Antistax* about *Martis*, *Helice* and *Bura*: before-mentioned in the *Corinthian* straites: some haue bin of opinion that the whole *Mediterranean* within *Hercules* pillars, was in time past habitable land, till it gaue way to the violence of the *Seas* invasion: But in this I credit nothing without farther-ground. The like vncertainties are also related of the *Atlantick* *Ilards*, greater

greater then all Africa, swallowed vp of the Ocean: which Columbus was laid in a sort to haue discouered in the Sea, finding a great shallow fraught with weedes, where he supposed this great Iland to haue stood. But I rather beleue that this Atlantick Iland spoken of by Plato, was either a Poët-call fiction, as *Moores Utopia* with vs, or at least the Continent of America perhaps in those dayes obfcurately discouered, but the discouery lost againe to after ages.

3. *Certaine Regions by reason of great Rivers are subiect to certaine Anniversarie Inundations, which commonly happen betwixt the Tropicks in the summer, without the Tropicks in the winter.*

The former clause is proved by experiance almost in all great Riuers in the world, which at some times of the yeare liue higher, overflowing their bankes, and drowning a part of the land about them. But this happens not alike in all places; for in Riuers included within the Tropicks, as *Nilus* & *Niger* in *Africa*; and *Oregiana* in *America* with others there-about, this *Anniversarie Invndation*, is in the *Summer*, else-where it is commonly in the *Winter*. For the former these causes may be assigned; 1 The melting of the *snow* on the Tops of the great mountaines in those parts, which is greatest of all, when the *Sun* is neerest or verticall ynto them, which we are to accompt their *Summer*. 2 The daily *Raines* and *Showres* such regions are subiect vnto; These shoures are much more frequent and greater when the *Sunne* is neerest their verticall point on iust: The reason whereof we haue formerly shewed to be this; That the *Sun* daily in those parts drawes vp more vapours, then he can dissipate and consume; Whence meeting with the cold of the *middle Region* of the *Aire* they are condensated in o drops, and so turned into *Raine*. For the later case in riuers situat without the Tropicks, commonly happens the contrary, to wit, that such Inundations happen rather in the *winter* then the *Summer*,

whereof these reasons may be rendred. 1 Because Raine and shomres whereof such ouer-flowing are engendred in those parts, are more frequent in winter then in the Summer. 2 whereas neere the *Equator*, the snow is knowne to melt with the sun from the Tops of high mountaines, in other parts it seldom or never melts at all; (as may be thought) vnder the *Pole* or thereabouts; or else, if it melt, it happens, (as in the temperat Zones we see it doth) oftner by raine, then the heat of the Sunne.

4 Next are we to speake of *Earthquakes*: An *Earthquake* is a sensible motion and shaking of the parts of the Earth.

Amongst other remardeable affections of a place, which are not so ordinary, an *Earthquake* hath no small consideration, being oftentimes a meanes which God vseth to shew some great and extraordinary iudgment. But not to spend more on this subiect then may seeme meete for *Geography*, we will shew the *causes* & *kinds* of it, by which we may the sooner come to learne what *Regions* and places of the Earth are most subiect to this affection, which is necessary of a *Cosmographer* to be knowne. Concerning the *causes* of it, much dispute hath bin among *Philosophers*: some haue ridiculously affirmed, that the Earth is a liuing creature, & suppose with no lesse, if not greater absurdity, that the Earth being in good temper, doth rest and settle quietly according to her naturall disposition: From which temper if she be any way removed, as if she were sick, or pain'd in some part, she shakes & shivers. The relation of this opinion is a sufficient confutation. *Thales Milesius* would haue the Earth as a shippe to swytche on the Waters, which being somtimes as a vessell by tempests turned on one side too much, it takes a great quantity of water, which is the cause of *Earthquakes*: But this opinion is a poeticall fiction. Little more probable is the opinion of *Democritus*, that the Earth drinking in raine water more then her caverns can well containe, the water rever-

berated backe is cause of such a motion. But who can imagine that drops of raine falling into the Earth can be reverberated backe, with such violence to cauile such an extraordinary motion of the Earth? *Anaximenes Milesius* was of opinion that the Earth her selfe was cauile of her owne motion; for the partes of it being taken out (as it were) and broken, fall downe sometimes into a great depth, causing the vpper face of it to shake and tremble; to which opinion also *Seneca* seemes to subscribe in the 6. book of his naturall questions the 10 chapter; To which also accords the Philosophicall Poet *Lucretius* in these words.

*Terra superna tremit magnis concussa ruinis,
Subit ubi ingentes speluncas subruit etas.
Quippe cadunt toti montes, magnis, repente
Concussu late dispersant inde Tremores,
Et merito; quoniam plaustris concussa tremiscent
Testa viam propter non magno pondere tota.*

The vpper Earth seaz'd with great ruines shakes,
When furrowed age her vast ribbes ouertakes.
For mountaines great fall downe, and with the blowe
The Tremblings are dispersed to and fro.
Not without reason; when a small-siz'd waine
Makes houses neere the way to shake amaine.

This last opinion seemes to carry more shew of probability then the former; neither can any man deny, that sometimes the Earth in some parts, may shake by the breaking downe of some subterranean parts, whole suddain and violent motion may cause the rest being continuall to entertaine the like convulsion. But yet more generall seemes the opinion of *Aristotle* who would haue *Earthquakes* to proceed from a *spirit* or *vapour* included in the bowells of the Earth, as he testifies in the 2. of his *Meteours* the 7 chapter. For this vapour finding no way to passe out, is enforced to returne backe; and barred any passage out, seekes euery corner: and while it labours

hours to breake open some place for going forth, it makes a tumultuous motion, which is the *Earthquake*. Now least it should seeme improbable that so great a masse of Earth should be moued, and shaken, by so thinnē & rarefied a body as is a fume or vapour; Aristotle in the same place shewes the admirable force of winds aswell vpon the Aire, as on the bodies of liuing creatures: In the Aire; because experiance shewes that being stirred vp by a windy vapour it somtimes is knowne to moue rockes from one place to another, to pluck vp trees and shrubbs by the rootes; and sometimes to throw down the strongest and most stately buildings: In mans body, because by the stirring vp and agitation of the spirits, which are the Instruments of vitall and animall functions, sometimes one sick man can doe that, which cannot be performed by many stronger and abler men; as it hath bin tried sometimes, that a *Frantick* man hath broken very strong chaines, wherewith he hath bin bound; which many other men could not doe. Neither on the other side, can it seeme strange, that many and great exhalations, vapours, and spirits should be ingendred vnder the Earth; For almuch as the Earth is heated many waies. Many waies may be specified whence such fumes should arise; as, first, from the sunne and starres; Secondly, from the subterranea fires hid in the bowells of the Earth; Thirdly, in the winter-time by an *Antiperistasis*, the heat collecting it selfe downward to the inner parts of the Earth, which was before in the outward parts of it: The argument by which Aristotle would confirme this opinion, is drawne as well from the *time*, as from the *places*, wherein Earthquakes vsually happen: from the *time*; because then most Earthquakes are obserued to be, when most exhalations are inclosed in the bowells of the Earth; to wit, in the *springe* and the *Autumne*. From the *places*; because, for the most part *spongie* & hollow Regions, which may drinke in a greater quantity of exhalations, are commonly most subiect vnto it: for although many exhalations are dayly inclosed in the womb of the Earth, yet Earthquakes fall but seldomie; because the matter is ieldome so strong and violent as to shake the

the Earth: Wherefore some *Philosophers* haue expressed three principall wayes which make this *Earth-quake*: first when a great quantity of exhalations is suddenly ingendred, which for the greatnesse of it cannot be contained in so little a space: for then being almost choked, it seekes a way to fly forth: Secondly, when the Earth is condensated by cold, and driues the exhalation from one place to another, which flying hither and thither, shakes and strikes the Earth: Thirdly when the exhalation, the *cold* compassing it round by an *Antiperistasis*, begets *heat* within it, and so is rarified: for so being vnable any longer to confine it selfe to it's former place, it breakes forth, and so shakes the Earth: We must here note by the way, that not onely exhalations are cause of the distemperature in the Earth, but also *subterranean fires* and *windes*: all which by some are iudged to be of equall force in this action: for the division of Earthquakes so farre forth as it concernes the difference of places, we must vnderstād, that it may be either *Universall* or *particular*: An *universall* Earth-quake is that which shakes all the whole Earth in euery part, at least in the vpper face: whereof(I suppose) no *naturall* cause can be giuen, but the *immediate* and *miraculous* power of God: such an Earthquake happened at the time of our *Saviour's passion*, whereof *Didymus* a graue and ancient Writer left record. But that which is said to haue happened in the time of *Valentinian*, mentioned by *Orosius* in his 7 book of *Histories*, & 32 Chapter, is thought by graue Authours to be no *universall* Earthquake, howsoeuer for the large extent of it, it was thought to be *generall*. A *particular* Earthquake is that which is bounded in some one or more particular places, which for the causes before-alleged cannot be so farre extended, because the cavernes and convexities of the Earth, where such vapours & exhalations are contained, cannot be ordinarily so great as to extend to many kingdome and Regions.

¶ Regions extreame cold or extreame hot are not so subiect to Earth-quakes as places of a

Cc* Middle

Middle temper.

The reason is, because in places extreme *cold*, exhalations are not so soone engendred, and in so great a quantity as in other parts: on the other side in places which are extreme *hot*, the exhalations which are bred, are soone consumed with excesse of heat: both which may be confirmed by Instances. It is obserued that in the cold *Northern* parts (as *Olaus Magnus* writes in his 10 booke and 13 Chapter) Earthquakes are very seldome or neuer: so it is obserued by *Pliny* in his 2 book and 18 Chapter: and *Albertus Magnus* in his 3 book of *Meteours* tract. 2: That places which are very *hot*, as *Egypt*, are seldo:ne troubled with this shaking of the Earth: whereas places betwixt both, which are seated in a more temperat climate, find it not so strange.

1. Hollow and spongie places are more subject to Earth-quakes then lolid and compacted soyles.

We must here understand that *hollow* places are either such as'ye open to the Aire, or are hollow onely vnder, and close vpward. The former sort are not at all subject to the molesta-
tion of *Earth quakes*, because the *exhalations* fly out without i npediment: but the latter being more apt to engender and retaine such matter, must of necessity be more troubled. This is most plainly obserued in *Phrygia*, *Italia*, *Caria*, *Lydia*, wherein such motions are more frequent. To confirme this a little farther, we obserue that *hilly* and *mountainous* places, suffer this violence oftner then other parts; because there most commonly cavernes and concavities are more frequent then in *plain* countrys. But here by the way may be ob-
served, that *sandy* and *slaty* countrys are many times more free fro n Earthquakes then other places: an instance whereof was giuen before in *Egypt*, wherein neuer any *Earth quake* (as most Authors affirme) or at least but one (as *Seneca*) hath bin obserued. The reason may be giuen, that *sandy* places without any strife suffer the *exhalations* to disperce themselves: that

that flijy places want sufficient receptacles to entertaine them.

3. *Ilands are more often troubled with Earth-quakes then the Continent.*

This haue they found to be true in many *Ilands* of the *Mediterranean Sea*, and others also; chiefly in *Cyprus, Sicilia, Eubœa, Tyrus, Angris, Lippora*, and the *Malucco Islands* betwixt the *East and West-Indies*. The cause some would haue to be the *Antiperistasis* or *circumstancy* of the waters, which is apt to engender greater store of exhalations in the Earth. But neuerthelesse that *Ilands* are more subiect to *Earth-quakes* then *Continents* I dare affirme no other wise then probable; because some places in the *Continent* seeme very much affected, especially in *Europe*, aboue other places, *Constantinople* and *Basilea*, if we credite authors which haue written of this matter; in *Asia, China, and other Regions* adjoyning thereunto.

C H A P. XIII.

1. *The Naturall Affections of the Land* haue hitherto bin declared: We are in the next place to treate of the *Ciulli*; Those we terme *Ciulli* which concerne the *Inhabitants*.

2. *An Inhabitant* is a man dwelling in a certaine place.

The name of an *Inhabitant* (as we haue before noted) may be taken either *generally* for any living creature, residing in a certaine place, in which sense *Brute beasts* may be called *Inhabitants*; which signification is only *metaphorically*; or else for a

Reasonable living creature, whose abode is settled in any place or Region, in which sense we here take it. The consideration of the Inhabitants we haue referued for this last Treatise; following as well the methode of the first creation, as of Moses in the narration. For God proceeding in the first Creation according to the order of Generation, from the more vnperfect to the perfect, created not man before such time as he had furnished the Earth with all things agreeable and necessary for his vse; to which alludes the Poët in these Verses:

Sanctius his animal mentisq; capacius aet.
Deerat adhuc, & quod dominari in cetera posset,
Natus homo est.

More sacred and of vnderstanding minde,
A creature wants to gouerne every kinde;
So man begunne.

Of the Nature, Proprieties, Dignities, and other accidents of this principall creature, there wants no discouery; sith large volumes are stuffed with this theame, and every man which knowes himselfe can prevent me in this subiect: I will here speake of him so far forth as he is an Inhabitant or dwellee on the Earth.

3 In the Inhabitants we are to consider two things: either the Originall, or the Distortion.

4 The Originall is the off-spring whence all Inhabitants tooke their beginning.

Concerning the originall of people of the Earth, we are to obserue two things; First, the Distinction of originall; Secondly, the manner of Inuention: For the first, we must note that all Inhabitants of the Earth, haue a three-fold originall or beginning. The first was from the first Creation, the second was immediatly after the generall deluge, wherein all the seminary of living creatures was preferued in the Arke: The third, is the first stocke or originall of each severall nation: For this last, it is a matter which we cannot heere so well de-

fine, till we come to the particular description of each Religion, to which it properly belongs. It shall be enough in this generall part, to speake of the two first; as farre as approued Historie and observation shall direct vs: For the manner of finding out the originall of Nations, these rules are giuen vs by Bodin in his 9th chapter of the methode of Historie. The first is by the testimonie of approued Authors. The second is by the markes and fooresteps of Languages. The third may be drawne from the limits and knowne bounds and situation of Countries. This knowledge of the originall of Nations, hath bin a matter of no small importance: For (as Bodin observes) there is nothing which hath more excercised the wits of writers, or caused more ciuill discords and ruines of diuerse commonwealths, then the contention about the first originall of nations: which iarres and contentions (as I take it) spring from no other ground then the naturall pride in the minds of men, and the affection of Nobility: whereby it often comes to passe, that such men as haue risen to greatnes, by their Wealth, villanies, or other such like meanes, haue afterwards, to continue and bolster vp their vsurped dignities, sought out new pedegrees and Ancestors, to set a glosse vpon their owne base beginnings; a humor in our daies more affected, then praise-worthy; not only of priuat pertons, but of whole nations, which runne farre off to seek out their first originall, which with more ease and certainty, they might find nearer home. To let passe other examples we need goe no farther then the French and the Britanes, both which labour as much as may be, to derive their first originall from the Troians. The first from the lineage of Hector, the other from Aeneas; as if more glory were to be derived from Trojan fugitives, then from the valiant nation of the ancient Gauls and Germans, from whom they might derive a truer and a more certaine descent. The consideration of this antiquity of nations so farre forth as it concernes our Geographicall discourse, reseruing matters of more specialty to our speciall part, we will comprise in these Theoremes.

I *All Nations had their first originall from one stock, whence afterwards they became divided.*

We must heere vnderstand (as we haue before noted) that all Nations haue a three fold originall, the first before the vniuersall deluge, the other soone after, the later long after. For the first, no doubt can be made by such as credit the truth of holy Scriptures, but it was from *Adam* the first father of mankind: For the last, it is doubtfull and various, and therefore cannot well be handled in generall, before we come to the description of particular countries; where we are determined to make a search as neere as can be in to their original: But that which we chiefly heere note is the *second* offspring of mankind soone after the flood: For certaine it is, that all mankind was confined to the familie of *Noe* in the *Arke*, so that their first originall must be drawne from the *Arke*, and that place where the *Arke* rested, presently vpon the falling of the waters: which we shall proue to be farre *Eastward*. Hence is the manifold arrogancy of many nations well discouered; for amongst the *ancients* some haue somuch affected the antiquity of their race, that forgetting their humane condition, they haue derived their nobility from the Gods. Which humour hath not only invaded the minds & affections of foolish & ignorant men, but also of such as haue stood in great opinion and estimation of wisdome & vertue: In somuch as *Cesar* in a certaine oration to the people of *Rome*, was not ashamed to boast, that he was descended by his Fathers side from the Gods by his mother from Kings: As also *Aristotle* deriuued his offspring from *Apollo* and *Aesculapius*: which strang affestation was little lesse in people of lower and baser condition, who either being vtterly ignorant of their owne offspring, or at least dissembling it, for the hate they bore to strangers haue called themselves *πανχθώνες* which is as much to say, as a people bred of the same region, not fetching their descent from any other nation: In which sense *Aristides* in *Panathe-*

neis gives the greatest nobility to the Athenians; to wit, that being borne of the Earth the mother of the Gods, they derived not their descent from any other forraine countrie: and this error is obserued not only amongst the ancient, but also with the newer writers, to be so common, that *Polydore Virgil* otherwise a prudent writer, affirms the *Britaines* to be a people taking their originall from the *Inland* countries and not derived farther. The like is written by *Athamerus* that the *German* nation being first bred in *Germany* owed their originall to no other; Which he labours to confirme out of *Tacitus*, *Sabellicus*, and *Sepontinus*. But (as *Bodin* speakes ingenuously) the ancient might well be excused in this error: But these men are subiect to great reprehension: 1. Because they being *Christians* seeme to reiect the authority of holy *Scriptures*, which testifie that all mankind was derived frō the self-same originall, being (as we haue saic) all confined in the *Arke of Noah*. 2 Because by this meanes, giving to nations no other originall, then from their owne countrie, they distract & divide each one from the mutuall loue and society of other Nations. For besides many other reasons which moued *Moses* to write of the *Genealogies* of people, this one seemes not the least, that men should understand themselues to be all (as it were) kinne, and descended from the same originall; then which there is no greater meanes to conciliate and ioyne mens affections for mutuall amitie and conversation. As it is reported of *Diomedes* & *Glaucus* and many others, who being armed to one anothers ruine and ouerthrow, haue bin drawn to breake off their hatred by the meere pretence and shew of consanguiniti: But these who so arrogantly boast themselves to be sonnes of the *Earth*, not beholding to any other country for their offspring, striue to breake in sunder the bonds of society betwixt nations, which *Gods* word and the *Law of Nations* binds vs to obserue. Hence grow those mortall hatreds and heart-burnings betwixt diuers countrie, as of the *Egyptians* against the *Hebreues*, of the *Greeks* against the *Latines*, wherein they persecuted one the other extreamly. Hence came it to passe that *strangers* amongst the *Romanes* were

were called enemies, as the name of *Welch-men* with the *Germanes* signifieth as much as a *forrainer*; wherein they seeme much to degenerate from the ancient hospitality of their Ancestors, for which they haue bin much praised. Finally from this one root spring those infamous libels cast out of one Nation against another, written by such *fire-brands* as delight in nothing more then dissention; but how much better were it to reconcile all people out of this assured ground of consanguinity, sith *Religion* perswades more to *charity* and agreement, then to *factions* and contentions. But this I leave to the Diuine, whom it more properly concernes.

2 *The first inhabitants of the Earth were planted in Paradise, and thence translated to the places neare adioyning.*

For the confirmation of this point we need no farther proof then the authority of *God* himselfe, speaking in his word, whereon all truth is grounded; But of the place of *Paradise*, where we place the first habitation, sundry disputes haue bin amongst *Divines* sufficiently examined, of late by a judicious and worthy writer in his *History of the world*. Which tract being too tedious to insert, we will contract as farre as concernes our purpose. First therefore it would seeme meete that we examine their opinion, which hold this *Historie of Paradise* to be a meere *Allegory*: Of this opinion were *Origen*, *Philolideus*, *Fran. Georgius* with many others: who by the sowre ryners of *Paradise* would haue to be understood the foure cardinall vertues: as by the *Tree of knowledge*, *sapience* or *wisdom*: To which opinion also *St. Ambrose* seemes to adhere: who would haue that by *Paradise* should be meant the *soule* or *mind*, by *Adam* the *understanding*, by *Eue* the *sense*, by the *serpent* *delectation*, by the rest of the *trees* the *vertues* of the *mind*: Against the Fathers themselues I will not inveigh, sith some men suppose their conceits to be rather *allusions*, then *conclusions*. But against the opinion it selfe, many reasons may be drawne to proue there was a true locall *Paradise* Eastward: first out of the text it selfe, which saith; *For out of the ground*

ground made the Lord God to grow every tree pleasant to the sight, and good for meats: by the proofe of which Story it seemes that God first created man out of the garden, as it were in the world at large, and then put him in this garden: the end whereof is exprested to dr. se and manure it; *Paradise* being a garden filled with plants and trees, pleasant to behold, and good for meate: which proueth that *Paradise* was a *terrestrial* garden. Secondly, to expresse it more plainly, he averreth that it was watered with a riuier springing out of a Region called *Eden*, being a Country neare vnto *Canaan* in *Mesopotamia* as *Ezechiel* witnesseth. Thirdly *Epiphanius* and *S. Hierome* vtge to this effect; if *Paradise* were such an *Allegory*, then were there no *Rivers*, no place out of which they sprung, no *Eve*, no *Adam*, and so the whole *History* should be turned into a meere fable, or poëticall fiction. Fourthly, it is proued by continuation of the same Story: 1 Because God gaue *Adam* free-will to eate of every tree of the garden (the foresaid tree excepted:) besides he left all the beasts of the Earth to be named by him, which cannot be meant of imaginary trees and beasts: for this were to make the whole *Creation* *enigmatical*. 2. This name is often vsed in holy Scriptures else-where, as in *Ezech. 21.9. Genesis 1.2.19.* which would not haue bin so, if the whole story had bin merely *Allegoricall*, and *Paradise* an *Utopia*; sith the Scriptures, especially the historiall part of them, are written in a plaine stile, fitting the capacity of vulgar auditors. Lastly of this *Paradise* planted in the *East*, we may find some footsteps in prophane Poëts, as in *Homer*, *Orebis*, *Limus*, *Pindarus*, *Hesiod*, who often speake of *Alcinous* garden, and the *Elysian* fields: all which deriueth their first invention from this description of *Paradise*, recorded by *Moses* in Holy Scripture, whereof the *Heathen* themselues had some obscure traditions. The second opinion was, that *Paradise* was the whole Earth, and the Ocean the fountain of these foute riuers; which was defended heretofore by the *Manichees*, *No-
viomagus*, *Vadianus*, and *Goropius Bezanus*. The reasons which they allege for their part to proue this assertion, were chiefly these: 1 Because those things which were in *Scripture* attri-

buted to Paradise, are generally ascribed to the whole world, as that place of *Genesis*; Bring forth fruit and multiply, fill the earth, and subdue it, rule ouer every creature. But this argument may easily be answered: for although the world in generall were created for man, and all men descended from the same originall, to wit, the loynes of *Adam*; yet this disproueth nothing the particular garden assigned to *Adam* to dresse, wherein he liued before his transgression: for if there had bee ne no other choyce, but that *Adam* had bee ne left to the universall (as they imagine,) why should *Moses* say, the garden was East from *Eden*: sith the world can not be East or West but in respect of particular places? Also why was the *Angel* set after *Adams* expulsion to barre his re-entrance, if it were not a particular place: for according to their opinion *Adam* should be driven out of the whole World. Their second reason is, because it seemes impossible that *Nilus*, *Ganges*, and *Euphrates*, by so many portions of the world so farre distant, should issue out of the same fountaine. To this we answer, that by common *Interpreters* of Scripture, being ignorant of *Geographicie*, *Pison* was falsely taken for *Ganges*; & *Gihon* for *Nilus*: Although it can no way be true that *Ganges* shou'd be taken for a riuver by *Hannalah* in *India*, and *Nilus* shou'd runne through *Ethiopia*, as we shall shew hereafter. The third opinion is, that Paradise is higher then the *Moone*, or higher at least then the Middle Region of the Aire: this opinion is cast vpon *Beda* and *Rabanns*; to which also *Rupernus* seemes to accord: who (as it seemes) borrowed their opinion from *Plato*, and he from *Socrates*. But these two (as it seemes) are misinterpreted, because by Paradise they meant Heauen it selfe as many imagine. But to confirme that this terrestriall Paradise is such a place, some men produce these Arguments. First that it is reported by *Solinus*, that there is a place exceeding delightsome and healthsome on the top of Mount *Athos*, called *Acrothones*, which being seated about clouds, or raine, or such inconveniences, the people by reason of their long liues are called *Maenobios*. Secondly they alleage for the hight of this Paradise, that *Enoch* was there preserved

from

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from the violence of the flood, as *Isidore* and *Peter Lombard* fmaintaine: But this opinion was of the Diuines condemned in the *Florentine* councell: and first where as they say, that such a pleasant place is in the top of the mountaine *Athos*; this neither proues that this is Paradise, neither is it so high as they would haue it: For euery high and pleasant place is not Paradise. Secondly, whereas they would haue *Enoch* and *Elias* preserued in the place, it is expressely against *Holy Scripture*, which affirmes directly that the waters ouer-flowed all the mountaines, making no such distinction. Secondly, should we credite this, we might as well believe that certain Giants saued themselues in that high place, as some haue believed. Besides the answer of their frivilous arguments, these reasons may be brought against their assertion: First, that such a place cannot be commodious to liue in: for being so neare the *moon*, it had also bin too neare the *sun*. Secondly, because in this sort it had bin too neare a neighbour to the Element of *fire*. Thirdly, because (as many hold) the *Aire* in that Region by the motion of the heauens is carried about so violently, as nothing there can well consist. Fourthly, because according to *Ptolemy*, the place between the *Earth* and the *Moone* is seuentene times the *Diameter* of the *Earth*, which make by a grosse ac-compt about 120000 miles. Hence it must needs follow that Paradise being lifted vp to this great hight, must haue the compasse of the whole *Earth* for a *basis* or foundation. But this cannot be imagined: first, because it would be subiect to the eyes and knowledge of men. Secondly, it would hide the light of the *Sunne* for the first part of the day being on the *East* side. Thirdly it would ouer-poize the *Earth*, and so make it to shrike out of his place; one side being farre greater and heauier then the other. The fourth conceit is of *Tertullian*, *Bonaventure*, and *Durandus*, who would haue Paradise to be seated vnder the *Æquator*, because that contrary to the opinion of most of all the Ancients, they thought this place to be most pleasant and commodious for habitation. It is true that the places vnder the *Æquinoctial* are not so burnt with the *Sunne*, as some thought: but, as we haue proued out

of later Navigatours, very pleasant and fruitfull for the most part: yet cannot this be the place of Paradise; forasmuch as the Riuers of Paradise mentioned in holy Scripture, are not found to meet there: which argument might also confute them which thought it was seated vnder the North-pole. The last opinion which I hold the truest, is of some later Writers, that Paradise was seated in a Region South-east from *Mesopotamia*, which is most amply and copiously proued by *S^r Walter Rawleigh*, to whom I referre my Reader: onely two reasons I will alleage. The first from the name of *Eden*, sith there is found an Iland of this name North-west from the place assigned, very fruitful and pleasant in all commodities of the earth, and in later times knowne also by the name of *Eden*, which is likely to haue bin continued from the beginning. Secondly from the Riuers of Paradise, which cannot be imagined to meet in any part of the world: for *Tigris* and *Euphrates* it is certaine that they are found in this very Region: for the other Riuer *Gihon*, that it is falsely vnderstood of a Riuer running through *Ethiopia* is also most certaine; for such a Riuer could never meet with *Euphrates*, which is out of question one of the Riuers of Paradise: forasmuch as it is so far distant & diuided from it by the Mediterranean Sea; wherefore I am constrained rather to embrace their opinion which interpret *Chus* to be a part of *Arabia*, where *Chus* the father of *Noe* settled his first habitation; which for this cause he called after his own name: but afterward in processe of time his posterity growing exceeding large and populous, they were enforced to passe ouer into *Africa*, and so settle themselues in *Ethiopia*, which place also they called after the same name: as we haue seene of later yeares the *Spaniards* at the first discouery of the *West Indies* called one place *Hispaniola*, and another *Hispania Nova* in remembrance of their former habitation. But howsoeuer it be, certain it is, that Paradise was seated in the East, from whence mankind had it's first off-spring. And probable it is that *Adam*, being excluded out of Paradise, was cast into some place neare adjoyning therunto, which may also from our habitable place of the West, be accounted Eastward.

3 The first plantation of Inhabitants immedi-
ately after the Deluge begunne in the east.

As Adam the father of all Nations before the flood began his offspring in the *East*, neere *Paradise*, so the second father of Nations *Noah* in the *East* first beganne to repeople the world, after the deluge: Which besides the clearer testimony of *holy Scripture*, may sundry waies be demonstrated: First, because it is most certaine, that the Earth beganne first to be peopled, neere the place where the *Arke* rested, which is the mountaine *Ararat*: Whether this be a mountaine of *Armenia* as the common Interpreters imagine; or the mountaine *aucasus* betwixt *Scythia* & *India*, as some later Writers with greater probabilities haue guessed, hath suffered a great dispute; all agree in this that it was *Eastward*. I will not be here ouer curious, but refer it to our historiall part, where we shall particularly handle the memorabile accidents, of particular places: Enough it is to proue that the first plantation after the flood was *Eastward*: 2^{ly} no small probability is drawne from the *civilitie*, *magnificence*, and *populosity* of these *Eastern* nations before others: For it is certaine that many excellent *Arts* haue flourished amongst those *Eastern* people, before euer our *western* climat dreamed of such matters: Amost many other matters, *Artillery* & *Printing* was in use amongst the *Chinois* and *East Indies* of ancient time, long before this inuention was known to vs; as the *Portugalls* who haue trayailed thither haue confirmed. To the vse of *gunnes* and *ordinance*, many suppose *Philostratus* to haue alluded, speaking in the life of *Apollonius Tyanaeus* lib: 2. cap: 14. Where he saith that the people dwelling betwixt *Hyphasis* and *Ganges* vse not to goe farre to warre, but drue away their enemies with *thunder* and *lightning* sent downe from *Jupiter* By which meanes it is said that *Hercules* and *Bacchus* ioyning their forces were there defeated, and that *Hercules* there cast away his golden shield. For the other Inuention of letters howeuer it were by the *Gracians* ascribed to *Cadmus*, as the first Inuentor, because he was the man that first discouered it to the *Gracians*; it is most

certaine that it was as ancient as Seth: And that Printing first came to vs, from this Easterne part, appeares by Iohn Guttemberg, who brought it first out of the Easterne world: Which art Conradus being instructed in, brought the practise thereto to Rome, which afterward one Gesnerus a French-man much bettered and perfected: For howsoeuer amongst the Europeans this inuention seemed but newly borne, yet the Chinois had it before either the Egyptians or Phanicians: When the Graecians had neither knowledg nor ciuility: which is witnessesse aboue a hundred yeares gone by the Spaniards and Portugalls. Farther for the magnificence of those nations, an argument may be drawne from the Historie of Alexander the great, who found more stately buildings and Cities in the little kingdome of Persia which lay side by side against the East Indies, then in all his former trauailes: for in Alexander's time learning & ciuility were not spread so farre west as Rome: Neither did he esteeme of Italy any otherwise, then of a barbarous and vnciuill place: which made him to turne his army rather against Babilon and the east, which seemed a farte wothier prize: Moreover, Paulus Venetus shewes, that letters and discipline was first borrowed from the easterne people, without any retурne of interest. A third reason may be from the extraordinarie strength of those easterne people in most ancient times. For it's reported by Diodorus Siculus out of Clesias that Semiramis the wife of Ninus, not many discents from Noah, brought an army to invade India, of three millions, besides horses and waggoners: Neither had Sturnobates her aduersary smaller multitudes to encounter her: which extraordinary strength and multitude of men could not possibly issue out of any Colony, sent thither from the westerne parts: And therefore it must needs follow, that they had their first offspring and originall in those easterne parts neere India. Sundrie other reasons might bee alleged, but these I suppose will suffice to fortifie this assertion. Then it is manifest that the first Plantation of nations begunne in the easterne parts of the Earth: But where we shall place and define this Easterne part, seemes a matter of greater difficulty then the other.

ther. Sir Walter Rawleigh out of the premised arguments, would seeme to proue, that this first plantation was farre as farre as *India*, neere which, he would haue the *Arke* to rest, to wit, on the mountaine *Caucasus* lying betwixt *India* & *Seythia*: Notwithstanding the authority of the learned Author, I find that the most ancient writers haue drawne the original of all nations soone after the flood, from the *Caldaans*, or at least amongst all, made them the first: For confirmation of which opinion, they vrge many strong arguments: In the first place, they vrge the testimonie of *Moses* in the 11 of *Genesis*, where speaking of the first assembly of people after the flood he relates, that they came from the *East* into the plains of *Shinaar*, in which place stood *Babilon* the chiefe seat of the *Caldaans*. To this they addde the testimonie of *Metasthenes*, *Herodotus*, *Ctesias*, & *Xenophon*: which haue afterwards bin seconded by *Diogenes Laertius*, *Philo*, *Porphyry* in a certaine epistle to *Boethius*, *Clemens Alexandrinus* in *Stromatis*: *Eusebius de Euangelica demonstratione*, *Theodoretus lib: 1. de Gracrum affectionum curatione*, *Rabbi Moses. Maimonie filius lib: 3. cap: 30. Perplexorum*: with almost all the Interpreters of the *Hebreos*: All which with vniforme consent haue affirmed that *Civility*, *Arts* & *sciences*, deriu'd their first descent from the *Caldaans*. Hence they saigne that *Prometheus* being a *Caldean*, for that he recal'd men from a wilde life to a more ciuill conuersation, and taught the regular motion of the *starrs* and *planets* before vnownne, stole fire from *heauen*, and animated men formed out of clay, with a *celestiaall soule*. But aboue all which may be collected in this kind, no small argument may be drawne from the *markes* and *footesteppes* of the *Hebreo* and *Chaldey* tongues, which in no mixture of tonges, or proesse of time could euer be abolished: For this, being the first of all other *languages*, was preserued by *Abraham* and his posterity; And challengeth antiquity before euer the *Latm* or *Gracian* tongues had any memory: in somuch as all the ancient nations of the world are found in most of their originall names of Gods, peoples, Princes, and places, to make vse of the *Hebrew* or *Chaldey* tongues, differing onely

In dialet, which without manifest wresting and absurdity, cannot well be derived from other later languages. The first father of the people of Europe was *Iaphet* the sonne of *Noe*, according to the ioynt consent of Hebrewes, Græcians, and Latines: To which alludes the Poet, where he saies, *Audax Iapeti genus*. This name יַפְתָּח or *Iaphet* in Hebrew signifieth as much as Dilatation or enlargement: Whereas the Greeke Etymologists ridiculous draw it from many other originals: In the like sort *Tacitus* ignorant of the Hebrew, would haue the people of *Palasino* to be called *Indei* quia *Idai* from the iniquitaane *Idai* in *Crete*, from which he dreaties they were derived; whereas the word in the Chaldy signifies, as much as Prayers. In like manner *Ion* or (according to *Hommer*) *Iaon*, supposed the first Author of the *Iones*, would the Græcians derive from a flower, whereas the word in Hebrew signifies as much as a deceiver: Whence *Daniel* prophesied of *Alexander* the great, that the King of יְהוָה that is *Iaon* or *Ianan* shou'd raigne in *Affria*. Instances in this kind are infinite, as of *Danauis*, drawne from יְהוָה *Dan* which signifies a iudge, whence comes *Dardanus* which is the seat of Judges: Of *Ianus* from יְהוָה *Iayn* signifying wine, in which sence he is by *Halicarissers* called *Venotrius*: Of *Arbeis* which signifies *Greece, Egypt* which is streight or narrow. *Nimrode* Rebellions. *Ninus* a sonne, *Ninive* the house of *Ninus*, *Solon* quia *Solam* a peace maker. So *Cadmus* supposed to be the father of letters & learning, amongst the Græcians, signifies in the originall, so much as an Easterne man or an ancient man. Should we runne any further on this point, we should be thought to write a dictionary, for as much as all the anciente names amongst the Græcians spring from the same fountaine: Whence that Egyptian Priest had good reason to object to *Solon*: That the Græcians seemed children, because they had nothing anciente amongst them: But to better purpose a Christian objected to the Græcians that *Moyses* the Lawgiver to the Christians was ancienter then all the Græcian Gods; Other reasons are taken from the Religion of the Hebrewes, out of which seeme to be derived all the famous religions

religions of the Earth: For to let passe the Christian, Iewish, & Mahometan Religions at thisday flourishing, all of them challenging great antiquity, and taking a great mixture from the truest and ancientest Hebrew discipline: It is manifest that in the Heathenish superstitions themselves, many footesteps haue bin discouered: which will appeare by diuers Instances. These arguments I confess seeme very strong, but yet not of sufficient strength to enforce credulity without other warrant: To say peremptorily with Mr. Bodin, that by the consent of ancient writers, the Caldeans are acknowledg'd the most ancient people, is more then I dare to venture: Neither is this opinion so strongly fortified with arguments, but Reason may steppe in to haue a doubtful assault. Their first argument drawne from the testimony of holy Scriptures in the 11 of *Genesis*, seemes to stand on our side, altogether against them: For whereas it is said, that they came from the east into the plaire of *Shinaar*, it is manifest that the *east* was first peopled; or else how should this people come from the east into these plaines of *Shinaar*, to erect the tower of *Babel*? Secondly, whereas they vrge Arts, Civility, Magnificence of the *Caldeans*, we shall find it rather to agree to the people which dwell farther east, as is witnessed by the former instances: And if any object that at this day is found the contrary, for as much as we find the *Indian* to be a barbarous blind and ignorant Nation, in respect of the *Asiatickes* and *Europaeans*, we answere two wayes: 1. First, that we find not by experience the *East-Indians* to be so altogether deuide of civility, but that we may obserue not only amongst them the footesteps, but also the practise of many ingenuous Arts, sage government, policy, and magnificence, as amongst the *Chinis* & the large territory of the great *Mogull* 2. It is not hard to imagine, that in so large a tract of time, the best fested common wealthes should be brought to nought, arts, civility, magnificence, be forgotten, and the rarest Inuention be cast into oblivion, especially by those two enemies of civility, warres & luxury: both which hauing the raignes in their own hands, are quickly able to abolish all wholesome discipline,

both in Lawes and Religion. 3 Their Argument drawne from the footsteppes of *Languages* in my shallow conceit, proues nothing els but that this Lawes, Arts, and Learning was derived to the *Grecians* from the *Caldeans*, or the Nations neare adioyning, which formerly receiued it from them. But how farre Learning might propagate it selfe the other way towards the East, is not a matter so cleare and out of question. The preservation of the Language (for ought I see) might grow from the continuance of the Religion, more firmly rooted, and for a long time continued in *Abraham's* posterity, whose abode was settled thereabout, whereas the other farre divorced, aswell from their first spring, as the monumetall seales of their Religion, quickly turned Religion into Pagan Idolatry: Many reasons besides the disprouing of this former opinion may be alleged to proue the *Easterne* part of the world to haue bin first peopled: amongst which I will only cull out this one, grounded on the text of holy *Scrip-*
ture. It is warranted out of the text: 1 That when the waters began to decrease vpon the face of the earth, and the *Arke* began to rest vpon the mountaine *Ararat*, *Noah* sent out a dove to make tryall, who returned with an oylie branch in her mouth. 2 That neare the place he issued out of the *Arke* with all his family, he planted a vineyard, and was drunke with the juyce of the *Grape*, not knowing the strength thereof: out of which by all probable conjecture must needs be collected, that the Regions neare the place where the *Arke* first rested, by the benefit of Nature afforded both Vines and Oliues: for we cannot imagine the silly *Dove* at the time of the flood empty gorged to haue flowne very farre ouer the face of the waters to obtaine this Oylie branch, nor *Noah* after the flood to haue gone very farre to seeke out a convenient place for his Vineyard: whence it is most likely that the *Arke* rested in such a place, whose neare adjoining Regions are enriched with such commodities. But this cannot be verified of *Armenia*, wherein for ought my reading informes me, are found neither Vines, nor Oliues, whereas some places Eastward, wher-on the *Arke* according to this other opinion was supposed to rest,

rest, afford both in great plenty. To vmpire betwixt these two opinions, I leaue to my friendly Readers; because it is not in our power to command, but obey Reason.

C H A P. XIII.

I  F the originall of Inhabitants of the Earth we haue spoken: It remaines wee now treate of their naturall Disposition.

There is nothing more subiect to admiration, then the diversity of naturall Dispositions in Nations; a matter evident to the eye of observation, and needing no prooфе or demonstration: for who obserues not in all Nations certaine naturall or nationall vertues or vices, which neither time nor Lawes could euer change or correct. For not to rouse fart her off then our neighbouring Nations Confines; what Writer in this kind almost, were he not very partiall, hath not taxed pride and ambition in the *Spaniard*; levity, or rather (as *Bedin* would haue it) temerity in the *French*; dangerous dissimulation in the *Italian*; Drunkennesse in the *Dutch*; Falshood in the *Irish*; and gluttony in the *Englysh*? And howsoeuer many means haue bin put in practise, either by the seuerity of lawes to curb such enormities, or the subtilty of discourse to shroud these vices vnder the name of vertues: yet these markes are found to stick as close as the spots vnto the *Leopard*, as neither altering their pristine hue, or yeelding to time or statutes: And if it happened at any time that by extraordinary violence some litle alteration were wrought, yet some few yeares would find it returne againe vnto his own nature and disposition. This variety of dispositions being very many, and depending on sundry causes, to helpe memory, we will reduce into certaine heads, out of which in the generall we may giue

a judgment, leaving the rest to our speciall Tract. The name of naturall disposition in this place we take in the largest sense; so farre forth as it comprehends vnder it the Complexion, Manners, Actions, Languages, Lawes, Religion, and Government. All which so farre forth as they depend from the places we will shew. Neither intend we to handle nicely all these specialties, forasmuch as the Manners, Customes, Lawes, (and for a great part) the externall rites of Religion depend on the naturall constitution of the Inhabitants: so that little can bee spoken of the naturall constitution, but of such actions, effects and markes as shew themselves in their ordinary customes & manners. Wherefore we shall be constrained to treat of them together, the one being a great furtherance to the explanation of the other.

2. The natural disposition of the Inhabitants of the Earth may suffer change and diversity, either in respect of the site, or in respect of the quality of the soile, or in regard of the Inhabitants themselves.

3. The site is the respect which one place in position beareth to another: Here a Nation is divided into, 1 The Northerne or Southerne, 2 The Easterne or Westerne.

4. The Northerne is placed in the North Hemisphare, betwixt the Equatour and the Artick Pole. The Southerne on the opposite side betwixt the Equatour and the Antartick Pole.

Of the Northerne and Southerne inhabitants we speake not here respectively, as in regard of the same Hemisphare, but absolutely in regard of the two Hemispheres and their

Inha-

Inhabitants: How these 2 Hemispheres of North and South are varied in respect of the quantity and disposition of the soile deciphered before. What diversity shalbe found in the people or inhabitants shalbe shewed in this Theoreme.

I. *The people of the Northerne Hemisphere are as well in riches and magnificence, as valour, science, and ciuital government, farre surpassee the people of the South Hemisphere.*

The people of the Northerne Hemisphere we understand to be the *Europeans*, the *Asiatiques*, the *hithermost Asiatiques* being the greater part the *Inhabitantes & Americas Maxima*, with the *hithermost part of America Peruana* together with the people inhabiting the *vnknowne land*, lying under the *Artick pole*, with all the *Islands* belonging to each of these. The people of the *Southerne Hemisphere* contained in the *Southward of the Africans*, the *inhabitants of America Peruana* for the most part the people of the *Terra Australis incognita* or the *south Indies*, with some *Islands* belonging thereto. Between these two partitions, if we make a comparison, we shall find a greater disparity then ever any Inuentors of man could any waies reduce to any shadow of Equality or any Travellers observation could ever stepp into diminish. To begin with the *riches*: It is certaine, that the increase of it in any nation proceedes, either from the benefit of the *soile* or from the *skill and diligence* of the *Inhabitants*. The benefit of the *soile* either in respect of the *quantity* of the *groundy*, or the *quality* of the *soile* in this *southerne part*, we haue at large proued to be farre inferior to that of the *Northerne Hemisphere*. The *diligence* of the people we can measure no otherwise then by their *Traffick* with *forraigne nations*, or their *good husbandrie* of their *owne commodities*. Their *traffick* with *forraigne nations*, is suspected to be little or nothing at all, in respect of the *northerne Inhabitants* having *small commerce* or *knowledge* of *forraigne nations*, and that rather enforced by *violence* and *conquests*, then any *way* desired of them.

them: Whereas scarce can be found any nation of the Earth, which cannot by commerce or traffick with forraigne Countries, at least neighbouring confines both strengthen theselues, & draw riches from other nations: Less can be hoped from their homebred industrie, which is content with sufficiency, neuer aiming at farther riches then naturall necessity seemes to exact, as may appeare by all records and Histories almost which haue treated of this matter. If we consider the state & magnificence of either, we shall acknowledge a great difference, as disdaining all comparison. The first offspring of all nations owes it selfe (as we haue proued) to our Northerne-hemispeare, which that Almighty Creatour of all things blessed with knowledge and civill gouernment, before euer this Southerne coast was knowne or mentioned. All the acts of the old and new Testament performed on this side of the Aequator, can speake the state and magnificence of these nations, leauing the other as yet neglected without memorie or Historie. Neither hath the Christian religion, the true ground of all setled gouernment euer bin so propitious, as to smile on these miserable Nations, as yet groaning vnder the seruile bonds of grosse Ignorance and Pagan superstition. Where shall we find in any records or antiquities, any state amongst them to parellell the fourre greater Monarchies of the *Affyrians, Medes, and Persians, Gracians, and Romans*, or the later risen vp out of their ashes, whereof this one age can produce no few examples? What place is extant at this day in *Europe, Asia, the Northerne tract of Africk or America* (some few Deserts onely excepted) which haue not bin either by knowledge receiued from forraigne Nations, or some other meane in some sort reduced to civility? At least to haue embrased some setled forme of gouernment: Whereas the Regions daily discouered in the Southerne moity are found most barbarous, without lawes, sciences, or civility. Or if any such perfection shew it selfe amongst them, it is manifest that it is owed altogether, to the industrie of the Europeans, who with great cost and travaile, haue brought them such riches whereof the poore wretches neuer knew the want. Instead of

so many Colonies sent out of Europe & Asia into these Southerne Regions, no record I suppose can mention one euer sent from them vnto vs. Which is an argument of their ignorance and want of traffick. What shall I speake of the valour and prowesse of the Northerne inhabitants, hauing by the sword erected so many kingdomes, and (as it were) without resistance brought into captivitie those Nations of the South? of Arts and Sciences what can be said, but that the Northerne Inhabitant hath all, and the other in a manner none: For libe-
rall and ingenious sciences our Schooles and Vniuersities dis-
persed in most parts of *Europe* and else-where can speake our
glorie: Whiche for ought I could euer learne the Southerne
Continent, neuer saw; and admit they know some thing in
some Mechanicall arts, it is no more then necessity requires.
Neither in the number and extre^t of Inuention, or curiositie
of workmanship answearable to that we find at home. The
artes of Printing & Artillery were I suppose neuer of their ac-
quaintance, except perhaps the later, which I dare fweare hath
had better acquaintance then welcome; as that which neuer
shewed it selfe but to their ruine: No obiection can heere take
place in this comparison, except some man suppose the mo-
numents and Trophies of these nations, either being very an-
cient haue miscarried by time, or else being of a newer birth
are hid, wanting the light of discouerie: But this is a mere
conjecture wanting ground: For what Antiquity or record
could euer shew so much, as the footesteps or marches of any
such monuments? as for the countries as yet vndiscouered,
no better conjecturall iudgement can be giuen, then by that
which is already found: For where all other reason and obser-
uation is silent, I alwaies hold *æquality* the best measure: An-
other argument not inferiour to the rest, is the antiquity of
the Northerne nations, which without all question is farre
greater then that of the Southerne: Because we can not ima-
gine any man so adventurous to passe into these remote quar-
ters, till such times as the places neerer adioyning, growing
too populous, constrained them to seeke out a new habitati-
on; whch no man could conceiue to be but in many yeares
after

after the vniuersall Deluge.

- 5 Each Hemisphære with the iuhabitants therein contained, may againe be diuided according to the *Longitude* or *Latitud.*: according to the *Latitude*, inhabitants may be called either the Extreame or Middle.
- 6 The Extreame inhabitants are either the Northerne or Southerne. The former in the hither Hemisphære. The other are the inhabitants thereunto opposite in the other Hemisphære.
- 7 The middle Inhabitants are such as are situate in the middle betwixt the *Equatour* and the Pole in either Hemisphære.

The mistaking of the true limits of North and South in this our Northerne Hemisphære, hath caused great error amongst the Ancients: In somuch as *Hippocrates* pronounced the people of the North to be of a leane & dry disposition, of a small and dwarfish stature; whereas other Writers out of a good observation haue found them to be of a tall stature, big-boned, & of a moist able constitution in respect of those of the South. To compose which difference we must haue recourse to that sub-division of the Hemisphære before mentioned, wherein we allotted of the 50 degrees accompted from the *Equatour* to the Pole, 20 for heat, 30 for cold, & 30 for tem-
per. min. Whereof the former lyeth Southward to the *Equatour*; The second is accompted from the Pole, the other is con-
ceaved to lye betwixt both: But because we find this Mathe-
maticall division to be too precise to answere the observation
of Writers in this kinde, we must a little alter these bounds,
that these rules may rather stoop to *Nature* and observation;

then

then Nature be squared to our owne conceits; yet shall wee shew in a generallitie, and for the most part, that the naturall disposition of the Inhabitants, ought to be iudged and measured according to these limits: though not exactly answering in precise degrees. Wherefore towards the North we limit these (with Bodin and other good Writers) which ly from the 50th degree Northward to the 75th; in which Tract we shall find our *Brittaines, Ireland, Denmarke, Gotland, the lower Germany* from *Mænus & Hispanus* to *Seychia & Tartary*, which take vp a great part of *Europe & Asia*: on the South we place the most Southerly Spaniards, the *Sicilians, Peloponnesians, Cretians, Syriants, Arabians, Persians, Susians, Gedrosians, Indians, Egyptians, Cyrenians, Carthaginians, Numidians, Libians, Moores*, and the Inhabitants of *Florida in America*. The middle Region is meant that which lyes iust in the middle place betwixt the Tropick and the Pole; not that which lyes betwixt the Pole and the Line: the reason whereof we haue shewed before; because the places vnder the Tropicks are found to be hottest, but vnder the Line more temperate; so that our temperate Clime here we place that which beginnes at the 40, and endeth at the 50 degree of *latitude*: In which Climat by the Northernmost *Spaine, France, Italy, the higher Germany* (as farre as the *Mase*) both *Hungaries, Illyria, both Mysia, Dacia, Moldavia, Macedon, Thrace*, and the better part of *Asia the lesser, Armenia, Parthia, Sogdiana*, and a great part of the greater *Asia*; so that all the Nations as yet mentioned in histories, and perferably discouered in our Northern Hemisphære are contained betwixt the 30 degrees of *latitude* and the 60. What to thinke of the Nations dwelling betwixt the two *Tropicks*, and those which are 60 degrees to the *Pole*, for want of accurate obseruation and *History* we can set downe no certainty: yet so farre as men may iudge by conjecture, we may accompt in the Region betwixt the *Tropicks*, the 15 degrees from the *Tropicke* towards the *Line*, to be of like quality with the 15 degrees without the *Tropicke*. The Tract in the middle vnder the *Æquator*, being more temperate, then that of the *Tropicks*, may be iudged to come neare

the temper of the middle Region betwixt the Tropick and the Line, though perhaps somewhat hotter. For the Regions very neare the Poles, lesse certainty can be collected: yet that little which we find concerning the nature of these Inhabitants we will not omit. According to this partition of our Northern Hemisphere, we may make judgment of the other; because where no other cause shewes it self, we may well guesse these places which are of equall site to be of a quall disposition, so farre forth as they respect the heauenly operation. All which concerne the naturall disposition of the Inhabitants, we will reduce to these three heads; to wit either 1 the bodily qualities; 2 the mentall Affections, 3 the outward Actions.

I *The Extreame Inhabitants toward either Pole, are in complexion Hot and Moift: Those toward the Aequator Cold and Dry: those of the middle indifferent as partaking of both.*

The confirmation of this proposition depends on 2 points: the first is the Declaration of the *Cause* of this Diuersity: the second is the *effects* and diuerse tokens which this variety of temper produces, as well in the Accidents of the *Body*, as the *Mind*. The caufe we haue partly before opened, which is the *Heat* of the *Sunne* in Climates nearer the *Aequator*, and the *Cold* in places farther remote, and situate nearer the *Pole*: whereof the former, working on the *Intervall heat* and moiftute of men and all other liuing creatures liuing in those hot Climates, drawes it out, and consumes it in such sort, that little remaines but *cold* and *dry melancholy*, as the *Seas* in the bottome; the other parts being (as it were) evaporated: For by how much more *heat* any man receiuers outwardly from the *heat* of the *Sunne*, so much more wants he the same inwardly; which every man may see confirmed out of ordinary experience; since that our *naturall heat* is far more vigorous in *winter* then in *summer*, and that our joints are more operative in *fresh* weather, and then when the *Northwinde* is stirring. On

the other side in the *Summer* we commonly obserue the contrary: we find our joints lazy and heavy, our Appetites dull, as may also be perceiued in the *English*, *Germans*, and *French*, traauailing from the *North Southerly* into *Italy* and *Spaine*, who if they confine not their diet to a sparing rate, they commonly are surprized by surfets: an example we haue of *Philip* Duke of *Austria*, living in *Spaine* after his *German* fashion. But on the contrary if a *Spaniard*, who in his own Country is inured to great Niggardliness, arriuе in our *Northerne Countrey*, he commonly proues a better trencher-man then our native Inhabitants. And this *Bodin* obserues to fall out true, not only in *men*, but also in *beasts*, which driven towards the *North* waxe fat, and proue well; but towards the *South* they pine away and waxe leane: which may well be confirmed out of *Leo Afer*, who averres, that almost throughout all *Africk*, you shall find few or no heards of cattle or horse; few sheep, and scarce any milke: where as each mans Table almost in *Germany*, and *Britannie* can giue a plaine demonstration of our Countreyes store in this kind. Hence may appeare that as the heat of the Sun towards the *Equator*, by drawing out the internall heat and moisture causeth men inwardly to be left cold and dry; so towards the *Pole* the internall moisture being preserued from the Excesse of Externall heat, and the internall heat being strengthened and thickned by externall cold, haue left vnto them a complexion of heat and moisture. The middle Region betwixt both extremes being compounded of both, must needs by mixture and participation injoy a middle quality. Besides this exposition of the causes of this temper we shall obserue many speciall markes and Instances which will discouer this variety of disposition. First, it is plain that heat and moisture are the two qualities of fecundity. Whence it must consequently follow, those Regions which are most populous to be chiefly endowed with this quality and disposition. Now where shall we of this Hemisphere find any Country to whom Nature owes a greater increase of mankinde, but in the *North* amongst the *Gathes*, the *Seythians*, the *Scandians*, and *Germans*, by whose abundant

dant fertility, vast deserts haue bin cultured and inhabited; stately Cities haue bin founded, Colonies haue bin transported and deriuied almost into all Europe? Hence haue *Methodius*, and *P. Diaconus* compared the armies of the North to swarmes of Bees; and the North is termed by *Olaus Magnus*, the store-house of mankind: to wit, from which so many strong Nations, as the *Gothes*, the *Gepida*, the *Hunnes*, the *Cimbrians*, the *Lumbards*, the *Alani*, the *Burgundians*, the *Normans*, the *Picts*, the *Heruli*, the *Suevians*, the *Slavi*, the *Switzers* and the *Russians* are not ashamed to deriuie their Ancestry. But here may be obiected that the Southerne people are much more addicted to *Venerie* then the Northerne, which seemes an argument of greater Heat: But to this I answer, that this insatiate appetite of *Venerie* in the Southerne people, proceedes not frō heat, but frō *Choler*, *Aduft*, & *Melancholy*: which humours carry in them a *salt* & *sharpe* quality (according to Physicians) which stirres vp their appetite to *Venerie*: which we may plainly obserue by experiance: for no men are more moued by this itching appetite of carnall Copulation, then *Melancholy* men. But howsoever this affection is most predominant in such men, yet it is hardly seconded by performance; which makes Geographers to ascribe more propertie of generation to the Northerne men, although sensuall concupiscentia raigne more in the Southerne men; which indifferent proportion was without doubt granted to either, by the prouidence of *Almighty God*, that they who were endowed with a greater sufficiency, should lesse affect sensuall delights then the rest, which want that proportion of *heat* and *moisture*: And those of the other sort should haue their Appetites more raised vp to wantonnesse, without the which their off-spring would soone faile. A second argument to proue our assertion is the *Tall* and *large* *stature* of the Northerne man, which argues both heat and moisture; where as the Southerne man is small and dwarfish in stature, composed of weake and feeble Nerves. That the people situate towards the Pole in a moderate distance, surpass in greatnessse, can be shewne not only in this our *Hemisphare* in the *Germans*, *Scythians*, *Belgians*, and

and others; but also in the other by the *Pantagones*, whose situation Southward answeres somewhat nearely to the hight of *Germany*. That moisture is a great cause of growth, appeares as well by Trees and other vegetalls, which growing in low and marshy grounds increase to a most incredible greatness; as of those fore-mentioned on the side of *Rivo Negro* in *Peru*, and here the Lake *Hiarotis* in *India* as by Beasts. For first we find the moistest to be of greatest stature, which is the reason why the great Whales and fishes in the sea grow to such a vast quantity. Secondly such Beasts as have hot & moist bodies cannot so well prosper and live in those Southern countries; as the horse which by nature being hot and moist, liveth but faintly in *Ethiopia*, yet is of good strenght in *Scythia*; Whereas the Ass being by nature hot and dry is of great accorde and seruice in *Africk*, in *Europe* little respected; in *Scythia* cannot live. Neither is moisture sufficient for the growth except it be stirred vp by heat: wherefore we may conclude hence that the Northern man hath birth Out of the contrary effects, we may likewise collect, that the Southerne man wants this quality. These reasons indifferently prove these qualities to wit, of heat and moisture, to be in the Northern man, and the contrary in the Southerne. Divers other arguments are urged, some to prove the one quality, some the other apart. A great argument of heat in the Northern man may be his extraordinary drinking: A vice which could never be reformed or corrected by times of plagues. This growth of theirs stirring vp this desire of drinking, can proceed from no other cause then their heat. Whereas the Southerne man is seldom taxed of this vice, not because he is more religiously temperate then the Northern; but rather for the naturall temper of his body, which can neither require, or beare somuch as the Northern. I say somuch as *Bodin* seemes to make a doubt, whether the immoderate drinking of the *Spanians* is to be esteemed a greater fault, then the niggardly sparing humour of the *Italians*: both arise rather out of nature then education. Another argument of heat in the Northern man, is the extraordinary strength

in respect of the Southerne man, which is an apparent demonstration of heat. We find that the bloud of the *Seythian* is full of small strings such as are in the gore of Bulls and Bores, and betokeneth strength: Whereas the bloud of the *Africar* is thinne, such as is in a Hart or Hare. No lesse are those reasons which especially proue the Northerne man to be endowed with much moisture. Thirdly we may much better argue from the Physiognomical accidents of the body: we shall find the inhabitants vnder the Tropickes to be exceeding black: vnder the Pole it selfe beyond 60 degrees somewhat browne, but from thence about 60 their colour is reddish: from thence to 45 degrees whitish; about the 30 they begin to wax yellow; and then somewhat enclining to greene: all which proceeds out of the variety of heat and cold. For the Blacknesse of the *Africans* about the Tropickes, we can ascribe to no other certaine cause, then externall heat, and internall cold his necessary concomitant: neers to which approcheth the yellow and greene colour of the people not farre off. Wherof the former discouers *Choller* and *Aduision*: the other *melancholy*. And how soever the brownnesse of the people dwelling very neare the Pole may come by reason of externall cold, which by excesse rather dries vp their moisture, then strengthens the internall heat: Yet the Red colour of the Inhabitants about 60 degrees is a firme argument of heat: and the white hue of the middle people, an apparent marke of a middle temper. No lesse may be collected from the eyes and haire of these three Nations. The eyes of the *Scythians* are generally tending to a gray colour: The remote haue them of a blē whitish shining colour; as the *Cymbrians* and *Danes*, according to *Plutarch*. The *Britannes*, *Germans*, and *Normans* come neare vnto this colour, but haue them not altogether so gray and shining but more obscure. But the Southerne man hath the colour of his eyes much enclining to black. Now if we will beleue *Aristotle* in his *Problemes*, the gray colour of the eyes is a very great argument of heat: But the blackish colour argues the want of heat: Those which dwell in the middle Regions haue for the most part their eyes of a darke blē, which colour

colour is apparant in the eyes of Goates, which as *Pliny* writes are neuer purblized or dim of sight. Many special arguments besides those before mentioned, are produced to shew the Northerne man to surpass in moisture as the other in drouth: The first may be taken frō their voice, which in the *Scythian*, or *Northerne* man is tending to hoarsenes; but in the *Africans* very sharp & shrill, the *Ethiopians*, & *Carthaginians*, and the most southerly as in *Spaniards*. That this difference doth arise frō the moisture of the one, & the want of it in the other may as easily be perswaded; because we obserue *women* which are moister then men, to haue sharp & shriller voices: Also that too much moisture in wood or mettall makes the sound of it very hoarse and harsh; as we see in *lead*, whereas other mettalls giue a shriller sound: Another reason is drawne from their extraordinary sweating; for it is obserued, that *Northerne* men traueyling towards the *South*, or warring in hotter Countries, are like to faint and perish through extraordinary sweating, as *Plutarch* in the life of *Marius*, records of the moist bodies of the *Cimbrians*. Thirdly it might seeme wunderfull which *Tacitus* relates of the *German* nation, that they loue sloth and yet hate rest; because (as in Children) the naturall heat pro-
vokes them to Action; but the moisture procures Softnesse: whence they must either fight or sleepe. Hence the *Italians* & *Spaniards* make accompt, if they can suffer or withstand the first or second assault of the *French* or *German*; easily to van-
quish them; because as *Marius* and *Casar* obserued of the *French*, that in the first assault they shewed thei selues more then men, in the second lesse then men. A fourth reason not inferior to the rest may be drawne from the soft bodies, of the *Germans* and *Scythians*, not any way patient of *fatigue*, hun-
ger, and thirst, although very strong and able to giue a sud-
daine encounter or venter on a warlike exploite: The contrary in all shall we find in the *Southerne* man; out of which we may well collect, that he enjoys a contrary tempers: Besides all which we haue laid concerning this assertiōn more shall ap-
peare hereafter by these subsequent Theoremes.

2. The extreame Inhabitants towards the Poles are more naturally inclined to Mechanicall workes and Martiall endeauours: the Extreame towards the Equatour to workes of Religion and Contemplation: the middle to lawes and civility.

There are found 3 kinds of discipline, which vsually invade and occupy the mind and faculties of man: The first are mechanicall and externall operations, the which are projected in the Intellectuall part, yet receive their perfection from the bands and externall organs: Such as are Artillery, making of ordnance: casting of mettalls, and chymicall inuentiones, Printing and the like arts. The second is Contemplation, separate & removed from externall operation. The third as the meane betwixt both, is civill and morall discipline, whose act and perfection consists, in the making of Lawes, establishing and gouerning of states, prescribing and maintaining of divine worship, with other matters of the like nature. These gifts it pleased God so to distribute to mankinde, that the former should be most appropriate to the Northerne man; the second to the Southerne, the third to the inhabitants of the middle region: in such wise as the one should need and not envy the others perfection. All which we shal demonstrate first out of the causes and ground; Secondly, out of the effects. The causes we haue shewed in the former Theoreme, wherein we haue ascribed to the Northerne man abundance of heat and moisture in respect of the other; which are the cheifest aides of the imagination, on which mechanicall faculties depend; also their plenty of bloud and humours distempering their minds: they are, by this meanes lesse given to contemplation. The Southerne men hauing cold and dry braines are of greatest understanding in Contemplative matters, being (as it were) by reason of melancholy abstract from externall operation. The middle temper of the braine and humours must needs

be

be the mother of a middle discipline, which is found to be that which concernes manners, lawes, and religion. Heere some haue gone about to reduce these three kinds of people to three planets answerable to these 3 dispositions. Over the Southerne people they set *Saturne*: the Northerne they commit to the gouernment of *Mars*, the middle inhabitants to *Jupiter*. The power of *Saturne* according to the *Chaldaans* consists in *Contemplation*: of *Jupiter* in *practicall action*, of *Mars* in *Artificiall operation*. Which 3 properties may be well gathered out of the *Hebrew* tongue, natures best interpreter; for *Saturne* they call נָתָן which is as much to say as quiet; because nothing better befits the nature of contemplation then retired quietnesse: *Jupiter* they call יְלָצָן which is as much to say as *Just*: Which the *Gracians* hauing receiued from these *Hebrewes*, they fained *Jupiter* to be the God of *lustice*. *Mars* they called מָרָדָם which signifieth strong or puissant, for which cause the *Chaldaans* and the *Gracians* would haue *Mars* the God of warre. To *Saturne* they ascribe *cold*, to *Mars* *heat*, to *Jupiter* a *temperature* betwixt both. To the first, they impute the inuention of *sciences* and such as concerne *contemplation*; To the second *practicall prudence*; To the third *Arts* and *workmanship*. Whereof the first depends from the *understanding*, the second from *practicall discourse*, the last from the *operation* of the *phantasie*. But to come neerer the matter and descend to particulars: we will first beginne with the *Northerne* man whom we shall find to be the father of most *mechanicall* *Inuention*s as of *Gunnes*, *Printing*, the art of *liquefaition*, *Chimistrie* with infinite other excellent *Arts*. Hence it comes to passe that the *Italians* and *Spaniards*, are vsed to send ouer for *Britaines* and *Germans*, as for those which are endowed with a heauenly gift in the *Inuention* of *veines* of *metalls* vnder the *Earth*, as also for the opening and well ordering of such *Mines*: Let any man cast his eyes on *England*, the *Neither-lands*, *Germany*, he shall find the *Inhabitants* generally, either as the *Schollers* and *darlings* of *Mars* *wielding* their *swords*, or as *Pioners* *levelling* of mountaines, or as *Ingmers* contriving the course of waters, or hunting in

the woods, or plowing in the field, or looking to their flokes on the mountaines, or working in their shops, or at least set vpon some externall worke or other; that their wits (as Bodin merily speakes) might seeme to be in their handes. From whence come for the most part our seuerall sortes of stoffes, our choice workes in wood, mettall, Ivory, our variety of instruments, from the Italian or Spaniard? No truly: they can rather admire then imitate; and better set vs the materialls then inuent the workmanship, like those distressed *Israelites* which were enforced to runne vnto the *Philistines* to haue their swords sharpened. As we ascribe to those nations of the North this perfection in operatiue and externall faculties; So cannot we deny the Scitherne man his due prorogatiue, which is *Religion* and *contemplation*. For these nations being aboue all other affected with *melancholy*, willingly withdraw themselves from common society into *Desarts*, and remote receptacles, more accommodated to abstracted meditaion: For contemplation (being of the Hebrewes tearemed a *precious death*) hath a speciall force to sharpen the wits of men, and by separation (as it were) from the dregges of the vulgar, not onely opens vnto him the secrets of nature, but giues him wings to flie vpto heauen in sacred meditation. Whence it cannot seeme strange that from these parts at first proceeded the *Prophets*, *Philosophers*, *Mathematicians* of great estimation. Also that almost all *Religions* of any great moment, owe their first originall to those parts: we need roue no further then the *Hebrewes*, *Chaldeans*, *Egyptians*, *Gracians*, whome we shall find the first founders of *divine* and *humane* sciences. Which historiacall obseruation dissenteth not any whit from the judgement of the *Naturalists*: Because (as *Huartus* obserues) the true foment of the best vnderstanding, consists in the *cold* and *dry brain* incident to *melancholy*. And *Aristotle* obserues, that *beasts* themselves are somuch the more eldinged to approch the prudencie of man, by how much they pertake the quality of cold. An instance of which may be giuen in the *Elephant*, whose blood (according to *Pliny's* Testimony) is coldest of all other Creatures. To this I might adde for an argument.

gumert of the religious disposition of the Southerne man, what *Leo Afer* writes concerning the vast number of Temples in some places of *Africke*, as about *Fesse* & *Morocco*, their strict observation of holy rites, their rigide Ecclesiastical censure, with such like. What is spoken by *Aluares* of the *hill Amara* in the middest of *Africke*, of their strange *Library*, *Churches*, *Pallaces*, with other matters of this purpose, would serue wel to my purpose, had I the ingenuity to believe the Jesuite. But against this may be object ed perchaunce that the *Christian* religion which is the truest and onely religion hath no great footing as yet amongst those Southerne nations. Secondly that their *Churches* haue no perfect platforme of Ecclesiastical government, as we find in other *Churches* towards the Northerne tract. To the first I answeare; that we heere speake of the *Inclination* of men to religious exercises, so farre forth as it depends on their naturall disposition, not respecting this or that religion; for to be informed in the true religion and reject all other, depends not any way on the naturall *Inclination* of men, but on the immediate guift of the Almighty God, which is pleased oftentimes to make election of one nation before the other, to make the one (according to the *Apostle*) a *vessel of honour*, the other of *dishonour*. To the second I likewise answeare, that in *Religion* 2 things are to be considered: First the *Religious* and devoute *Inclination* of man to embrace diuine contemplation: Secondly the well *ordering* and governing of religious actions, according to *Lawes* and *Statutes* pertaining to the externall regimement of the Church. The former only being granted to the Southerne man, we may ascribe the perfection of the other to the people of the middle region, whom we haue pronounced to be most happy in the managing of *civill affaires* and *politike government*. Now to preue this people to be best endowed with this facultie, many reasons may be alleged; because according to the testimonie of most approued writers, we haue found *lawes*, *manners*, *statutes*, and the best manner of governing common-wealtheis to haue proceeded from these nations. For *Histories* will shew vs, that the greatest and best empires

of the world haue flourished in *Asia*, *Greece*, *Asyria*, *Italy*, *France*, *Germany*, which lie betwixt the *Aquatour* and the *Pole*, from the 40 to the 50 degrees: And that out of these haue alway proceeded the best commanders, the most prudent states-men and *Law-giuers*, the wised *Lawiers*, the most eloquent *Oratours*, the wariest *merchants*. Whereas neither *Africa* in the *South* nor *Scythia* in the *North*, could euer boast of many *Law-giuers* or *states men* worthy note; whence *Galen* complaines that *Scythia* never brought forth any *Philosopher* besides *Anacharsis* of any great credit.

3 The People of the Extreame Region to-
wards the Poles in martiall prouesse
haue commonly proued stronger then those
neare the *Aquatour*: but the middle pe-
ople more prouident then either in the es-
tablishment and preseruation of Common-
wealths.

The grounds of this Proposition we haue laid before: for the former clause, that the people of the North should proue more puissant then these of the South, may well be concluded out of their naturall strength of body, and their courage of the minde: whereof the latter makes them ready to attempt, the other to execute most chivalrous desigues. Neither want there most true and pregnant examples in history to second this principle: for every man that is indifferently seene in history may obserue with wonder how the strong Na:ions of the *Scythians* haue invaded the *South*, winning from them many *Trophies* and *victories*: whereas we seldome find any expe-
dition set on from the *South* to the *North* (except to the losse
or ruine of the *South*) worth any memorable relation. To this
many would have these threatening prophecies of *Ier. Ezech. & Esay* to allude, which foretold, that from the *North* should issue
warres, troopes of horsemen, & the Ruines of Kingdumes: This
we shall obserue to be true not only in the generall, but al-
THOS

most in all particular States, which we shall find propagated from the North to the South. The *Assyrians* at first ouercame the *Chaldeans*; the *Medes* the *Assyrians*; the *Persians* the *Medes*, the *Greekes* the *Persians*, the *Parthians* the *Greekes*, the *Romans* the *Carthaginians*, the *Gorbes* the *Romans*, the *Turkes* the *Arabians*, the *Tartars* the *Turkes*: and howsoeuer the *Romans* by their prowelte wanne somewhat towards the North, yet found they by experience that beyond *Danubius* no great matter was to be expected; forasmuch as these Nations could not be easily vanquished, and being ouercome would not away with subjection: which (as some say) was the cause that *Traian* hauing built a great Bridge of stome ouer the *Danow*, was perswaded to breake it dōwne. *Tacitus* expressly confesseth, that the *Germans* were too hard for the *Romans*, and could not haue bin ouercome by them, but by the advantage of the weapons and maner of fight; wherein the *Romans* hauing long continued a ciuill Nation, had practised themselues: which he secondeth by many instances, drawne from severall conflicts betwixt the *Germans* and the *Romans*, which he might well speake; forasmuch as himselfe reports 210 yeares were spent in the conquest of *Germany*, & no Nation somuch troubled them as this; which notwithstanding when all was past, was thought to be triumphed ouer rather then cōquered. It were an infinit task to write all which *Tacitus* relates of the valour and warlike disposition of the *Germans*, being a Nation loving *rest*, and hating *Idlenes*, punishing cowardice with Death, and reputing it an inexpiable shame for a subiect to see his Prince slaine in Battaille, and retorne aliue without him. As much or more he reports from *Iulius Agricola*, then *Proconsul* of *Britany*, of our ancient *British* Nation, whose factions and dissentions amongst themselues gaue occasion to the *Roman* victory, and not the *Roman* valour wherein he confessed them no way to be *and inferior*. To strengthen this assertion, History will afford an evidence almost in euery corner of the world, wherein we shall find the *North* by sundry conquests to haue prevailed against the *South*: In the *East* parts we find that *Cingis Can* a Nor-

therne *Tartar* conquered the *Indians*; That the *Tartarians* also conquered the *Armenians*; and yet the *Armenians* had such advantage agaist the Southerne people, that the *Malukes* esteemed a strong Nation in *Egypt*, were first chosen out of *Armenia*. Also we find that the people of *Cathay* subdued the *Chinois* and the *Indians*. We read also that *Mahomet* a *Saracen* *Su'tan* of *Persia*, hired certaine Northerne *Seythians*, with whose strength he ouerthrew the *Caliph* of *Babylon*, who dwelt afterwards in *Turcomania*. Neither wants *America* many examples in this kind, and no question but many others haue bin drowned in obliuion for want of History. We find that the people of the North in this Continent prevailed agaist the South, and conquered *Mexico*, which was afterward subdued agaist by *Cortese*; and by later discouery of our *English* nation we are giuen to vnderstand that the people about *Terra de Laboradore* are a fierce warlike people, in somuch as rather then they would yeld themselues to be taken captiue by our men, they haue bin seen to make away the selues. To goe no further then our own country, who knowes not how many famous overthowes haue in iater Ages bin giuen to the *Spaniards* and the *French*; especially to the latter, who haue feared the vtter vndoing of their State: yet neither of these two great Kingdomes could euer attempt any thing against the *English* worthy Chronicle or obseruation: If any man obiect the actions of King *William the Conquerour*, we can answere many waies: first that he wanne the soueraignty not merely by the sword, but by *Agreement* and composition, challenging a promise from King *Edward* the predecesour, and being fortified with a strong faction of the nobility of the Realme: and moreouer the malice of the Subiects against *Harald* being an usurping Tyrant, gave great spurres to his victory: wherefore we cannot iudge this a true Conquest: yet hath *England* bin conquered of the *Danes* a moe Northerne people, and suffered many inconveniences of the *Scots*, but yet were neuer able to conquer them viterly, or bring them vnder subiectiōn; although fewer in number, and neare their Confines. Now for the second clause, that the peo-

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ple of the Middle Regio are more prouident in preservation of Common wealths is warranted out of the same grounds: for to this two things are necessary, to wit, *Armes and Counsell*: whence they v sed to paint *Pallas* armed, to signifie that not onely strength, but counsell was necessary for the establishment of kir gdomes. The Southerne people (as we haue shew ed) being altogether addicted to *contemplation*, haue bin vnable either to defend themselues, or repell an enemie. On the other side the people of the North hauing strength sufficient to assault, for want of *prudence* and counsell could neuer long enjoy their Conquests, so that we shall seldome read of any great Empire established of either. But the middle people ha uing strength to subdue the Southerne, and policy enough to c uercome the strength of the North, haue established many great and famous Empires. Here for an ample example wee may produce the State of the *Romane Empire*, which borrowed Lawes and discipline from the *Gracians*, nauticall Sciences from the *Sicilians* and *Puricks*, military discipline from their daily exercise: and therefore was it no great wonder, that in state and glory they surmounted all other Nations. On the other side we find many famous victories atchieued by the Northerne people, yet could they neuer leauie behind them any large Empire, but as easily lost as wonne their Kingdomes. Thus fared it with the *Goths*, the *Hunnes*, the *Heruli*, and the *Vantals*, which with so many strong Armies invaded *Europe*, and *Asia*, who neuerthelesse for want of *wisdom* and foresight, could not hold what they got, or settle therein any state of long continuance.

4 *The extreame Regions in manners, actions, and customes, are cleane opposite, the one to the other. The middle partake of mixture of both.*

That the manners of men depend on the naturall *complexion* and temper, is warranted aswell by experience as appro ued testimonie of our best Philosophers. For howsoeuer

grace

grace or education may make a change; yet this is extraordinary, and these raines once lool'd men easily retурne to their former disposition: How much the *Northerne* man differs from the *Southerne* in naturall constitution, we haue formerly taught; out of which we cannot but conclude, a great disparity in *manners* and *customes*: Yet to shew a more speciall & evident demonstration, we will make a particular enumeration of such affections as are incident to the *northerne* and *southerne* man, and out of the comparilom make our judgement.

First therefore, it is manifest out of ancient and moderne obseruation, that the *Northerne* man hath bin taxed of too much *levity* and *inconstancie*: The *Southerne* man contrariwise of too much peruerse *stubborneſſe*, as well in *opinion* as *affection*. The reason of both we haue before specified, to be their naturall *complexion*: which in the former is inclined to *sanguine*, in the later to *Choller Adust*, and *melancholy*: whereof the one is the more subiect to *change* or *impreſſion*, then the other. *Galen* deriuing all vertues from the *humours* of the bodie, makes *Choller* the mother of *prudence*, *melancholy* of *constancy*, *bloud* of *mirth*, *fleame* of *manuetude*: Out of the mixture of which *humours*, infinite variety ariseth. And because these *humours* are seldomē *equal*y, or proportionally combin'd, and temperd together; they become the sources of infinite *vices*: Which *Inequality* of *temperament* is rather found in the extreme regions: And therefore no marvaile if they are observed, to haue bin subiect to greater vices then those of the middle region: For the *mutability* and *levity* of the *Northerne* Nations, we can haue no greater argument then the change of religion: It is written of the *Ostrogothes* & *Visigothes*, that being expulſed by King *Attila*, they besought *Valens* that he would grant them a dwelling place: cōditionally promising, that they would submit theſclues, aswell to the *lawes* of the *Empire*, as to the *Christian Religion*. Which hauing obtained, they fled from their promile and perfidiously burnt the *Emperour* aliue. The *Gothes*, alſoone as they came into *Italy*, embraced the *Christian religion*, but ſoone ranne into *Arrianisme*: The people of *Greenland* accor-

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ding to *Munsters* relation, being of a wavering disposition, soone lik't the Christian religion, but soone relapsed to *Idolatrie*. The *Turkes* being a kind of *Seythians*, assoone as they came into *Asia*, without any great constraint, embraced *Mahometanisme*. The *Tartars* likewise, without any enforcement yelded first to Christianity, and soone fell backe to the *Arabian* rites. The *Normans* coming into *France* although very rude and barbarous, rejecting *Gentilisme*, *Paganisme*, subscrived to the Christians. Assoone or sooner the *Islanders* fell from *Idolatrie* to the true religion. The *Bohemians* and *Saxons* first cast off the *Romane* yoke; which were seconded by all *Saxonie*, the Cities of the *Balticke* sea, *Denmark*, *Norway*, *Suedia*, *Helvertia*, and *Britanny*. The revole of these nations from the *Romane* subiection, I cannot tearme *levity* or *inconstancy* in their cheife leaders and teachers: Being such as vpon long deliberation and mature advice attempted that, which they knew to be most consonant to *truth & reason*: to whom without doubt God almighty's hand was not wanting. But for the *rude* and *vulgar* people to be so soone wonne, and turned from one opinion to another, without longer deliberation, was argument of a *mutable* disposition: Sith there can be no greater token of *Inconstancy* then to make an absolute change of *religion* in all points in so short a space; whereas the religions being so nearly affined, the one to the other, no man at first sight, out of *reason* and *discourse* would embrace or reject all grounds together, but by degrees: No lesse argument of *levity* in those *Northerne* people, is the distraction and division of them into so many *sortes* and *fac-tions* of *Religion*, as we find now in *Germany*, *Belgia*, *Polonia*, and else-where, which no doubt at first proceeded from one or few beginnings. But on the contrary side, if we looke on the *Africans* and *Southerne* people, we shall find them as *obstinate* and *peruerse* in standing to their owne propositions, as ready to tax the *Northerne* people of *levity* and *Inconstancie*. For such hath bin the settled constancie of these nations, as well *Africans* as *Asiaticks*; that no meanes could be invented to draw them from their opinion, but either *heavenly* *miracles*

or force of armes. Which constancy hath bin apparent, not onely in men but also in *women* and *children*: which made *Antiochus* even mad when he by all cruelty tortured the *seven Sonnes* (as we find in the booke of the *Maccabees*), yet was as farre from turning them from their *Ceremony* of forbearing the eating of *Swines-flesh*, that both the *mother* invited them, and the *Children* willingly submitted themselves to *Martyrdom*. Against this *constancy*, *Mahomet*, when neither by fained *miracles* nor *persuasion*, he saw he could prevail, betooke himselfe to *Armes*; for the establishment of his *discipline* which otherwise he could no waies haue brought to passe. And it is strange to see the *Jewes* at this day, which being a *people* dispersed ouer the face of the whole *Earth*, groaning vnder the servile yoake of subjection, hauing no *King*, or supreme *gouvernour* of their owne, haue so obstinately retained their *religion*, for these three thousand *yeares*. What shall I speake of the *Mahometans* in *Africke* and *Asia*; of the *Indians*, the *Chineis* and other *Southerne* *people*, which hauing once settled a *platforme* of *Religious discipline*, are impregnable against all *persuasion*; mainly opposing themselves against the grounds of our *Religion*, hauing not somuch as the *principles* of *nature* to support their owne. To let passe the ordinary *commerce* and *traffick*, with *Christian* *nations*, which in so evident a case, might probably beget some *fruits*; the admired *Industrie* of the *lesuites*, erecting their *Colleges* amongst them, might seeme to promise greater *matters*. But as I haue credibly bin enformed, by such as haue travauiled, aswell into *Turky* as *Africk* and *India*, the euent of their labours hath come to farre short of expectation, that they haue by their *conference* rather engendred a worse opinion of *Christianity*. Which though some may impute probably to their *indirect meanes* and *superstitious rites*, imposing on the *conscience*, what God never commanded, but rather forbad: Yet who so shall obserue the cunning and subtilitie of these *Sophisters* will rather ascribe it to the *perverse* and *stubborne* *disposition* of the *people*, vnapt to receive any new *impressions*: For else, who could imagine they could be so powerfull.

full in perverting and infecting others with their Romane superstition in these parts, hauing their *consciences* better informed out of God's word, and their *understandings* ordinarily better taught, in principles, and every way more strongly fenced against temptation. As these Southerne nations alwaies boasted of their owne *Constancy* as a prime vertue, so ceased they not to vpbraide the Northerne man with *inconstant levity*. This the *Italians* object to the *French*, and *Germans* (as we finde in *Tacitus*). The *Greekes* heretofore to the *Italians*, the *Cretians* to the *Gracians*, the *Hebreues* and *Egyptians* to the *Greces* and *Cretians*; On the other side the other haue somuch complained of their perverse and settled *superstitions*. For to iudge indifferently of either, they are both vices declining from that golden *medisocracy*, which we call *Constancy*. For the defect is *levity*, the excesse *Pertinacy*: and as it is very culpable in any man to turne with euery winde; so it is as great an indiscretion, to be so wedded to our owne *opinions* or *affections* as to turne on no occasion: Because all things vnder the sunne are subiect to change and alteration: And therefore it is the part of a wise man to accomodate himselfe vnto the object, and not in a fond dreame to wrest all the world to his owne fancy. For a wise Sea-man will rather obey the storme then seeke his ruine, and when he cannot recouer the port, will turne to any other point for his owne preservation. I speake heere onely of matters of *state* and *policy*, and not of *religious actions*, otherwise then concerne the *externall rites* and *Ecclesiastical discipline*, the most part of which, by wise men haue bin esteemed no other, then matters *indifferent* which may admit of *change* and *alteration*. But heere some one might object that the *French* of all Nations, haue bin generally taxed of *lightnesse* and *inconstancy*, being notwithstanding in the middle region, more *North* then the *Africans*, yet more *South* then the *Germans* or *Scythians*; I cannot altogether excuse them of this Nationall blamish, yet with their countryman *Bodin*, I hold it more fitly tearemed *temerity* then *levity*, being a people very quicke and a-gill, aswell in *speech*, as *action*, in somuch as the *executions*

Of matters with them many times are past, ere the Spaniard can enter into consultation: for as the Spanish counsell is euer slow, & full of delayes, so is the French too heady & hastie: & as delay to the one, so rashnes to the other hath proued dangerous. The mediocrity betwixt both, being a *promptitude* or alacrity in effecting matters, is to be esteemed as a virtue, which we find in the *Italians*, whose action is *quick* enough, yet commonly grounded on sufficient *deliberation*: yet if we compare the two extreames, we shal find the Spanish delayes to haue ouercome the French *hastiness*, being farre lesse subiect to error, then the other.

Another difference betwixt the Northerne and Southerne man is discouered in the Affection of *Anger* and *Reuenge*. The *Northerne* man though quickly moued to anger, and verily furious, prouokes his enemy to the *open field*, and after a litle time is quickly pacified, forgetting the injury. The *Southerne* man contrary wise is not so quickly enraged, but being once prouoked, pursueth his reuenge by *secret stratagems*, rather then *open fury*, and will neuer or very hardly be drawne to *reconciliation*: which base and brutish disposition ariseth not so much out of their euill *education* (as some haue imagined) as out of *melancholy ill tempered*. A proofe whereof we haue in most men amongst vs, of a *melancholy disposition*, which according to our common prouerbe, threaten danger and hatred implacable: of this disposition were *Ajax* and *M. Coriolanus*, whereof the former for want of reuenge, in a distracted fury fell on the heards of cattle: the other would by no meanes be reconciled to his Countrymen, till he saw all their Cities in flames. Of the crueltie of the *Africans* many histories haue given testimonies, especially *Leo Afer*, speaking of the *Carthaginian* dissencion: and with later Writers most memorable is the story of miserable *Mulcasses* depos'd of his Crowne, his eyes burnt out, and his face disfigured, tending his complaint to the Emperour *Charles*. This crueltie hath no lesse bin observed in the most Southerne *Americans*, with whom it is a custome to bathe their children in the bloud of their slaughtered enemies, to drinke their bloud, and banquet with their car-

cases : And if we examine the originall of tortures and severe lawes, we shall find them originally derived frō the Southerne people, which the Northernne Man hath seldome vsed but unwillingly in matters of horrib'e treason. And not without good reason haue our Lawes taken other courses for the conviction of malefactors in cases of felonie and murther, then the extortiōn of confession by extreame tortures, a thing conuincing with the *Italian*; because (as some of our Statists haue obserued) our Nation is by nature more apt to confession without torture, and so fearefull of torment, that they will more willingly be brought to the *block* or *gallowes*, then the *racke*: wheras the Southerne people being by their melancholy temper more fearefull of death, and obstinate in their opinion, will yeeld rather to the greatest torture then confession.

Thirdly we shall find as great a disparity betwixt the *Northerne* and *Southerne* man in the *sluttish carelesnesse* of the one, and the cleanly *neatnesse* of the other. Tacitus reports of the old *Germans*, that they liued at home in their houses in sordide manner, almost naked, and that they vsed the same *roomes* as receptacles aswell of their beasts as of themselves: which custome we shall not find much changed amongst some, if we read *Lipsius* speaking of the *Westphalians*, or haue so much patience elsewhere to make experiment. It is also reported that the *Scythians* whensoeuer they found themselues oppressed on the way, or in the warres by hunger or thirst, were wont to open a veine vnder their horses eares, and to suck out their bloud, and to banquet with the *flesh*, as we read of *Tamerlane's* Army on the like occasion: but the Southerne people are of a neat and cleanly disposition, abhorring all sordide & uncleanly action, vsing often *bathings* & *washings*, not only in sacred and Ecclesiastical matters, but also in priuate. And therefore no wonder if (as *Xenophon* among the Ancients reports) that amongst the *Perſians* it were accompted a very unmanerly thing to spit; or that amongst the *Abyssines* (as *Alvarez* writes) it should be deemed a most hainous and flagitious crime, to drop any *filth* or *spittle* in any of their temples. An argument of this may be their extraordinary affection of neat &

dainty delicates, which (as *Athenaeus* relates) is most noted in the *Asiatickes* and *Egyptians*, by which meanes *M. Anthony* a luxurious spend-thrift, finding himselfe by *Cleopatra* surmounted, he smil'd at his own ambition in that kinde, and laughed at the *Romans* his own Nation as ignorant and barbarous. Of the *Persian Theophrastus* writes, that by a certain Law certain great rewards were promised to such men as had invented any new kindes of Delicates or pleasures, which is a great argument of the licorous affection of this Nation. A fourth difference may be discouered in the conversation of the *Northerne* and *Southerne* Man For the *Seythian* and *Northern* man is naturally addicted to company and society, as may appeare by the communion of many men in one place in the fields, who amongst the ancients were termed *Nomades*, and are now called *Hordes*; in which manner the *Tartars* liue at this day: also it is well knowne how much the *Germanes*, *Britaines*, *Danes* are addicted to company, insomuch as they can hardly liue long without companions. But the *Southerne* man being (as we haue proued) of a melancholy disposition, chuseth rather to liue solitary, and to lurke in woods and desarts, then amongst people: Neare to which nature come the *Italians* and *Spaniards*, who affect rather a retired *Granity*, then an open society, and converse but at a distance, rather for formality then friendship. ^{5ly} no leſſe disparity in the disposition of the *northern nations* shall we find awel in the *Languages* they ordinarily vſe, as the kinds of *musick* which they affect: for the former we may generally obſerue in the *Northerne Languages* a rough collision of consonants and aspirations, as in the *German* and *Bohemian* Tongues. Neither is this obſerued only in their native Tongues, but also in their vſe of the *Latin Tongue*, in pronunciation of which they cannot but mixe rough aspirations; as I haue obſerued oftentimes in the *Northerne Germans*, who commonly pronounce *firum* for *virum*; *fulgus* for *vulgas*, *Pipi* for *bibi*, with diuerſe other of the like nature: as vnable they are on the other ſide to giue any ſoft aspiration his due ſound, but commonly leaue it out altogether, or pronounce either the *vocales mediae* for *vocales tenuis*, and *aspiratae* for *mediae*, which proceeds

proceedes altogether from the immoderate strength of heat & force of the spirits. But the Southerne people contrarywise wanting that degree of heat; in their pronunciation abstaine from these hard aspirations and collision of many consonants together, without vowels to mollifie the harshnes; as we find in the *Greeke, Latin, Spanish, and Italian* tongues, which lye nearer to the South. Also the *Turkish, Arabian, and Persian* tongues are by such as are experienced in them, said to be *sweeter and elegant*. Also it is to be noted, that as often as the Colonies of the North haue invaded the South, although retaining the same foote-steps and originall, haue notwithstanding much altered their pronunciation not only through the mixture and impression of other languages, but also through the nature of the place, as we find the *Gotish tongue* of the *Spaniards* to be changed to a smoother and sweeter pronunciation, then that which is retained in *Scythia*. I speake not of the *Latin* mixture, but of the meere *Gotish* words, which we shall perceiue mollified with more vowels, and set to a sweeter termination. The like may be observed in the *Hebrew* tongue, which (as *Iosephus Abudachnon*, sometimes a Reader in this Vniuersity observed) to the eare sounded farre sweeter in the *Arabian, Turkish, and Persian* dialects then it's owne originall; not that it is in them more perfect (which were impety to beeleeue) but because men in pronouncing of a language preferring pleasure before significancie, haue mollified it, with soft vowels and aspirations, rather to serue the eare then understanding. No lesse affectation shall we finde of diverse sortes of musick, sortinge with their diverse dispositions. The Northerne mans humour consortes best with the *Phrygian* measure, a lond and stirring harmonie. The Southerne man haing his spirits more mollified affects the *Lydian*: The people of the middle region, are most of all delighted with the *Dorick*, a musick heeretofore vsed in sacred exercises. They who know these measures exactly, and which is agreeable to this or that mans fancy, will giue a probable guesse vnto his naturall disposition. To runne over all the differences in manners and customes of the Northerne and Southerne nati-

ons were a matter infinite; wherefore it shall suffice to wrap vp all in a generall recapitulation. If we compare the *Northerne* man with the *Southerne*, we shall find the one *white & red*, the other *black or tawney*; the one *big-baned*, the other *small and dwarfish*; the one *strong, but easie to be deceived*; the other *weake, but witty and circumspect*: The one giuen much to *wine*, the other exceeding *sober*; the one neglecting both *himselfe and others*; the other *carefull and ceremonious*: The one *rufitically arrogant*, the other *high minded*; the one *prodigall*, the other *parsimoniisus*: The one *temperate*, the other *lecherous*; the one a *slouen*, the other *neat and handsome*; the one *plaine and simple*, the other *craftie*; the one a *soldier*, the other a *Priest*; the one a *workman*, the other a *Philosopher*; the one standing on the strength of his *hands*; the other of his *wit*.

Out of the mixture of these *extremes*, it is no difficult matter to draw the disposition of the middle Nations. For finding the two extreme nations of the *North* and the *South* to be not onely diverse, but for the most part opposite one to the other, in disposition and manners; it were very rationall to judge the *middle* to haue a mixture of both, which observation will also approue: For if we compare the *middle* region with either *the extremes*, we shall find no such apparent diuersitie, as betwixt the extremes themselues. Heere *Monsieur Bodin* dreames of a *golden mediocritie* to magnifie his owne Countrye, which he finds in his *middle* region. For sithence both these extremes challenge an *extremite* of disposition, he imagines this *middle* tract onely reserved for *vertue & temperance*. But if he iustly weigh all in the ballance of *impartiell iugement*, he shall finde no such advantage. For first out of his owne grounds, to which we haue hitherto as-sented, he ascribes to the extreme nations an *eminencie* both of *vice & vertue*: Then cannot the *middle* challenge these qualities otherwise then *remitted*, and of *lesse force*. If therefore he would haue their inclination to *vice* more moderated, and corrected; he must also confess their disposition to *vertuous* actions to be of *lesse validity*. Againe these *middle* nati-

ons are to be accompted either directly situate betwixt both the extremes, or more inclining to the one then the other: For these directly in the middle, we must imagine them to per-
take of both dispositions, as well to vice as to *virtue*, borrow-
ing from either extreme as well good as bad: Heere therefore
can be found no disadvantage: For if they will boast of the
virtues of either, they must likewise be ashamed of either *vi-
ces*: If they plead a moderation of the former, they must loose
so much reputation in the later. For these which more nearely
incline to the one then the other, it will be apparent that as
they approach the one in one quality, so they are farther off in
another: as if they approach nearer, in *contemplation* to the
Southerne people, so will they come to satre short of the Nor-
therne valour. For by how much more they come neare the
virtue of the one, so much come they short of the others Af-
fections. The like may be judged of their Imperfections; so
weighing reason with reason we shall find no such inæqua-
lity and disproportion to magnifie the one, or vpbraide the o-
ther: for that Almighty *Creator* of all things is wont to di-
stribute his blessings in proportion: & *Nature* nis soueraigne
hand-maide triumphes in nothing more then variety. Thus
haue we spoken as farre as *history* and *observation* can iustifie
of the *laws*, *customes*, and *manners* of the *Extreme* & *middle*
Nations, in which we haue chiefly tied our discourse to the
Northerne and Southerne people in this Hemisphere, hauing
few *histories* to leade vs to the consideration of the other op-
posite on the Southerne Hemisphere: yet the causes being
like, we may out of the former be able to giue a judgment of
the later.

8. Hitherto haue we treated of the people of
the Northerne & Southerne Hemispheres,
with the speciall subdiuision of each into
Extreme or *middle*: It now remaines that
we speake of the diuision of Inhabitants

according to the *Longitude*.

9. According to the *Longitude*, Inhabitants are either in the *Easterne Hemispheare*, or *Westerne*. Those I learne of the *Easterne*, which liue betwixt the *Canaries* and the *Molucco Islands* on *this* side: The *Westerne*, those which dwell betwixt those two on *the other*.

These two Hemispheres of the Earth have by some bin called the *Old and New-world*, because the former containing *Europe, Asia, and Africk*, hath bin knowne to the ancients as the portions of *Noah's* three sonnes, *Shem, Ham, and Iaphet*, whereof (as the *Scriptures* testifie) *Shem* had *Asia, Iaphet* *Europa*, and *Ham Africa*. The other containing *America* the *South-continent*, and some other *Islands*, haue bin since discouered. Of the comparison of the Inhabitants of these two Hemispheres we will insert this Theoreme.

I. The people of the *Easterne Hemispheare* in *Science, Religion, Civility, Magnificence, and almost every thing els*, are farre superior to the *Inhabitants of the Westerne*.

For demonstration of this point we need not spend much time; first it is manifest that this Hemispheare was peopled a long time before the other, which is a probable argument of their *culture and civility*: because all these matters haue comonly their growth and perfection with *time* the mother of all perfections. That this part was peopled a long time before the other, is most credible; for it is plaine out of the *holy Scriptures*, that the first off-spring of mankind was in *Asia*; whence it could not disperse it selfe into *America* and other parts of

the Earth, till such time as their populous growth had required larger bounds. The passage from *Asia* into *America* without doubt had bin performed either by sea or land. By Sea it was improbable they should adventure in that infancy of the World, when the Art of Navigation was in her swathing bands, and neither the *Chart* or *Compass* as yet invented. If by land they made their passage, it was doubtlesse through the North of *Asia*, supposing *America* with *Asia* to be one Continent. But this people comming out of a pleasant and temperate Country, would without question first attempt the places of the like quality, as most pleasing their eye, and fitting their disposition, before they would inforce their passage to the *Icy* and frozen Climate of the *North*, which can only be beholding to necessity for habitation. Hence without doubt it came to passe, that those Nations wandring farre from their first fountaine, and leauing no sufficient monument to instruct their posterity in their first originall, came short of the other, as well in revealed as acquired knowledge: in revealed knowledge, either sought in *Holy Scriptures*, or *Traditions*, they could not but come short, as being most distant from the first head and fountaine where it was to be found in greatest perfection. In *Acquired knowledge* gotten by industry and experience they could not come so farre as the other; because all such knowledge hauing it's beginning from obseruation, and it's growth with age, could not be brought to that perfection amongst them, who came more lately to be a people, and scarce euer endowed with any settled government: but whatsoeuer the causes may be thought of this diuersity betwixt the people of the *Westerne* and *Eastern* Hemisphære, certaine I am that the effect it selfe is most apparant. Of the happy endowments of *Europe*, *Asia*, and a good part of *Africke*, bothe in *Arts liberall* and *mechanicall*, *state*, *policy*, *magnificence*, and *Religion*, we haue often spoken, and neede make no repetition. To this if we compare *America*, being (as it were) the only portion of this Hemisphære, we shall amongst them find few or no Arts either invented or taught, the vse of letters scarce euer knowne; *states* and *magnificence* little regarded, and the

Light of Christian Religion scarce euer seene; or at least through the dimme clouds of Roman superstition. He that would know more in this matter, let him read Peter Martyr, Cortesius, Acosta, and others, of the naturall disposition of the people of America.

10 The Inhabitants of such Hemispheare are againe subdivided into the *Easterne* and *Westerne*: the *Westerne* in the *Easterne Hemisphere*, are they who liue nearer the *Canaries*: the *Easterne* are such as are situate towards the *Moluccoes*: to which those other in the *Westerne Hemisphere* are correspondent.

The *Westerne* people haue bin obserued to be more happy and able in martiall discipline: the *Easterne* in witty contemplation, & speculatiue Sciences.

There is no small affinity (as we haue before touched) betwixt the *West* and the *North*, as betwixt the *East* and the *South*; as well in the temperament of the Aire, as the disposition of the Inhabitants: which cognition will appeare more fully by the proofe and demonstration of this Theoreme. Of the strength and valour of the *Westerne* people, many records giue evidence; we read of innumerable Colonies of the *Celtes* a people situate on the *West* of *France*, sent into *Italy*, *Greece*, & *Asia*. But the *Italians* durst never invade *France*, till such time as their Empire was at the height ynder *Cesar*, taking also aduantage of the home-bred ennemis of the Inhabitants among themselves: whence *Tully* the Orator tooke occasion to praise *Cesar* for subduing those Nations, and reducing them to the *Romans* obedience, whose strength the *Romane Empire* could hardly sustaine. The *Italians* haue oftentimes molested the

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Gracians, yet from them suffered little or small inconvenience; so the Gracians hauing with their Armes cut out a large way through Asia, scarce euer dared to come into Italy but once vnder the conduct of *Pyrrhus*, who being almost defeated of his Armie, was inforced to save himselfe by flight. In like sort *Xerxes* who brought men enough into *Greece* to dry vp the Rivers, was notwithstanding defeated by a few Gracians to his great dishonour. Wherefore *Cato* had good reason to obiect to *Mureas*, and *Cesar* to *Pompey*, that their warres waged against the People of *Asia* in respect of others were (as it were) rather agaist *women* then *men*. This without doubt gaue *Alexander* his greatest happines and victory, that he turned his Armes against the *Westerne* people, which were either altogether barbarous, wanting martiall discipline, or all ouer delicate, not able to resist such hardnes: whereas if he had opposed the *Westerne* people (by the censure of *Livy*) he had at least failed of those many Conquests, if not purchased a fatall ouerthrow. The obseruation perhaps of which courageous valour in the *Westerne* people was the cause why the *Turkes* heretofore were wont to chuse their *Janissaries*, and chiefe men of warre out of the *Europeans*, accompting them more strong and able then the *Asiaticks*, being of temper more soft and delicate. To this accords *Julian* in his booke against the *Christians*: the *Celtes* (saith he) are *Bold* and *Adventurous*: the *Greeks* and *Romans* both *warlike* and *civill*: the *Egyptians* more *industrious* and *subtile*, although *weake* and *tender*. The *Syrians* with great alacrity coniforme themselues to discipline: And a litle after hath these words: What shall I declare (saith he) how covetous of liberty and impatient of servitude the *Germans* are, how quiet and tractible the *Syrians*, *Persians*, *Parthians*, and all the Nations situate towards the *East* and *South* parts of the World. *Tacitus* reports, that the *Batavians* lying on the *West* of *Germany* of all the *Germans* are the strongest & most valiant: which *Plutarch* also confirmes in the life of *Marius*, that the most *warlike* people of all *France* are these which are most *Westerne*. The like opinion had *Cesar* of the *Westerne* Nations: of all the people of *Europe* (saith he)

the *Westerne* people of the *Brittaines* and *Spaniards* are the strongest. Now as the *westerne* people iustly challenge to themselves this prorogatiue of strength and valour, so must they yeld to the *Easterne*, that of *Religion* and *contemplation*. To let passe the *Indians*, which a long time gone, were enriched with knowledge, if we beleue ancient writers; who can deny the *Hebreuws*, *Chaldeans*, *Syrians*, *Egyptians*, *Arabians*, and others of the *East* their iust trophies of learning and contemplation, which they haue erected to after ages? From these fountaines haue the *Greeks* and *Latins* derived those large streames, wherewith they haue (as it were) watered all *Europe*. It is written, *That there came wise men from the East to worship Christ*; which must needs be vnderstood of *Chaldaea* or the places neare adioyning, where the *Magi* or *wisemen* were had in great reputation. If any object the decay both of *learning* and *religion* at this day, in the *easterne* parts of the world; We answere that this in most parts is merely *Accidental*, caused by the *hostile* invasion of the *surping Turkes*, which professeth themselues to be *utter* enemies to *learning* and the *true religion*. To which, we may adde the ignorance of the *Christian* religion in many places, which is the greatest ground of solide knowledge. For amongst all religions in the world, there is none which giueth more way to *learning* then the *Christian*: Whereas some others altogether forbid the studie of such matters; yet is not this inclination so absurd in the *Easterne* people, but that every-where some *markes* and *footesteps* will discouer their disposition. For in the *East* shall we find no small number of *Christian* *Churches*, and *Monasteries* professing *Christianity* and other good learning. But to speake no more of the *Christian* *religion*, which we hold rather by *Gods* speciall grace, then nature: the *superstitions* *devotion* of these heathen nations to their owne *false religions*, is a sufficient argument of their naturall inclination to *religious* *exercises*. How obstinately *perverse*, *Ceremonious*, and *superstitions* the *Indians* are found in *Idolatrous* *religions*, I haue often wondred to heare some *travaylers* *reporte*: Of the other *Hemisphare* comprehending

ding *America*, I haue as yet small evidence out of *Historie*, whereon to ground any certainty; all we can say shall be comprised in this Theoreme.

2. *The easterne part of the westerne Hemisphere
was peopled before the westerne.*

This proposition seemes probably warranted, as well by reason as authority; for first, supposing as an infallible ground, that the first offspring of all nations was in *Asia*, towards the *East*; it must needs follow, that to people *America*, there should be a passage therewnto out of *Asia*; because *America* was a long time not inhabited ere it was discouered to the *Europeans*. This passage then, was either by *sea* or *land*; Were it by *sea*, the first part whereat they could arriue was the *easterne* side. If we suppose it to be by *land* (as is most likely in those ancient times) yet was it most probable it should be on the *Northeast* side from the *Pole*, because it is found by obseruation that on the *North-west* side it is diuided from *Asia* by streites; then must they first touch on the *Easterne* part. To this we may adde the experiance of the *Castilians* and *Portugalls* (who first discouered this part) who affirme that the people dwelling on that side, haue bin obserued to surpass the *westerne* by farre in ciuility of maners, knowledge, and such endowments, which may be an argument of the antiquity of their plantation.

DHe second diversitie of disposition of inhabitants ariseth from the diverse nature of the Soile: Heere fowre distinctions of Nations are remarde.

remarkeable. 1. of the inhabitants of the Mountaines and plaine-Countries. 2. of marsh and dry. 3. of windy and quiet. 4. of sea-borders and Inland people.

That mens dispositions are diuersly varied according to the temper of the soile, euer mans owne experience may easily enforme him; for to referre particular instances to their proper places, it is most manifest that all the vitall operations of the soule depends aswel vpon the corporeall and organisall parts, as the spirits; which being diuersely affected by the qualities of the Aire, and Earth must needs vary and suffer a change. Plaine and evident disparity is found: first betwixt two nations situate in the same Parallel or climate in respect of the heauens. Secondly betwixt two men borne in severall Countries liuing together for some time, in the same region. Thirdly, of one and the selfe-same man liuing at diuerse times in diuerse regions. Fourthly, of a man liuing in the same Country at diverse seasons and times; all which being heretofore demostrated will declare vnto vs the great *Sympathie*, and *operation* the *Aire* and his diuerse qualities, hath with, and on our corporeall *Spirits* and *organs*. But the temperament of the *Aire* (as we haue formerly shewed) depends on the temperature of the soile: whence it must needs follow that the naturall disposition of men should be varied somewhat in respect of the soile. This disposition of the soile being monifold, we haue reduced onely to three heads: leaving other curiosities to such, as haue more leasure: What we iudge in this, shall be declared in these Theoremes.

1. Mountaine people are for the most part more stout, warlike and generous then those of plaine countries: yet lesse tractable to government.

Of the warlike disposition of the mountaine people and their strange

strange Impatience to subiiction, many Histories giue testi-
monie. Geographers report, that setting aside the people of
the *North* (to whom for strength & valour we haue giuen the
palme,) the Inhabitants of the mountaine *Atlas* are
great and strong, out of whom the Kings of *Numidia* and
Mauritania in time of warre are wont to levy their forces.
And it is worthy admiration to consider the mountaine peo-
ple of *Arabia*, who could neuer be drawne to yeeld to sub-
jection, but being fortified not somuch by the benefit of the
place (as some might happily imagine) but rather by naturall
strength and valour, haue alwaies liued in liberty. To whom
(as is reported) the *Turkes* giue a yearlye stipend to keepe
them off from invading the Territories of *Palaſtine* and *Da-
mascus*. Of the *Marsians* the ancient Inhabitants of the
Appenine mountaines in *Italy*, the *Romans* were wont so
well to conceiue, that it grew into a proverbe: *Sine Marsis
triumphasse neminem*. *Gostane*, when he went about to in-
vade the kingdome of *Succia*, chose his legions of soldiers,
out of the *Dalecarli*, who inhabite the *Succian mountaines*.
But amonſt all, no nation hath purchased a greater opinion
and reputation then the *Helvetians*, living amonſt the *Alpes*.
These men are originally descended from the *Suecians*, which
for valour, haue ſo farre approued themſelues, that they haue
not onely kept themſelues free from forraigne iurisdiction,
but haue often deluerned their neibouring countries from ſla-
very & oppression. Against the house of *Austria* they haue
not once diſplaied their banners, and triumphed in their ouer-
throw. A great part of *Germany* hath ſmartered vnder their
valour; and ſuch an honorable opinion haue they wonne, that
they are accompted (as it were) the *Censors* and *moderators*
to decide coniouerſies in matters of ſtate and kingdimes. *Ci-
cero* giues great commendations of strength to the *Ligurians*
inhabiting the mountaines: It is well knowne how long and
taedius warres the mountaine *Cilicians* and *Acrocerauarians*
had with the *Turkes*: how long with ſmall damage they
endured affront, & drove them back. Here we might add the
examples of the *Bifcaneſ* and *Cantabrians* in *Spaine*, who un-
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der the conduct of *Pelagius* their King, withstood the *Saracens*, and preserued both their *language* and *religion*. The like ought be spoken of the *Welch* and *Cornish* people amongst vs, as of the *Scottish Highlanders*: all which living in *mountanous countries* haue withstood the violence of forraigners, and for many yeares preserued their owne liberty. And howsoeuer it may be objected that the advantage of the place gaue them courage, yet can we not deny their disposition due commendation; having not only thus for a time protected their owne rights, but made many hostile invasions on their enemies. Hence *Bodin* would make a certaine *Harmony* betwixt the *mountaine* people, and the *Northerne*, esteeming the inhabitants of the *Alpes*, the *Pyraneans*, the *Acroceraunij* the inhabitants of *Hamus*, *Carpaibus*, *Olympus*, *Taurus*, *Stella*, *Caucasus*, *Imaus*, with diverse others of the same nature, albeit situate in the *temperate* part, to bee accompted *notherne* people: as also farther towards the *South*, the inhabitants of *Atlas*, of the *Arabian mountaines*, of *Pirus* and *Seraleona*, are (as it were) by him excepted from the *Southerne* inhabitants, in regard of their *high* and *mountanous* situation; whiche recompenseth the other, and challengeth as much *cold*, as by the heauens it should seeme to receiue *heat*. This conceit of Monsieur *Bodin*, I admit without any great contradiction, were he not ouer peremptorie in ouermuch censuring all *mountanous* people of *blockishnesse* and *barbarisme*, against the opinion of *Averroes* a great writer; who finding these people neerer *heauen* suspeeted in them a more *heavenly* nature. Neither want there many reasons, drawne from *nature* and *experiment*, to proue *mountanous* people, to be more pregnant in *wit* and *giifts* of *understanding* then others, inhabiting *low* and *plaine Countries*. For howsoeuer *wit* and *valour* are many times diuided, as we haue shewed in the *notherne* and *southerne* people, yet were they neuer somuch at variance, but they would sometimes meeete. First therefore what can speake more, for the witty temper of the *mountaine* people, then their *cleare* and *subtie* *Aire* being farre more purged and rarified, then that in *low* countries: For holding.

holding the *vitall spirits* to be the cheifest instruments in the soules operation, no man can deny but they sympathrie, especially with the *aire* their cheifest foment. Every man may by experience find his *intellectuall* operations more vigorous in a cleare day, and on the contrary most dull and heauy when the *aire* is any way affected with foggy vapours. What wee find in our selues in the same place at diuerse seasons, may we much more expect of places, diuersely affected in *constitution*. A second reason for the proofe of our assertion, may be drawne from the *thinne* and *spare diet*, in respect of those others. For people liuing on *plaines*, haue commonly all commodities in such plenty, that they are much subject to *surfetting* and *luxurio*, the greatest enemy and *vnderminier* of all *intellectuall* operations. For a *fatt belly* commonly begets a *grosse head*, and a *leane braine*: But want and *scarcity* the mother of *frugality*, invites the mountaine dwellers to a more sparing and *wholsome diet*. Neither growes this conuenience onely out of the *scarcity* of viandes, but also out of the nature of the *diet*. *Birds*, *Fowles*, and *Beasts*, which are bred vpon *higher places*, are esteemed of a more cleanly and *wholesome feeding*, then others liuing in *fennes* & *foggy places*: And how farre the qualitie of our *diet* preuailes in the alteration of our *organs* and *dispositions*; every naturalist will easily resolve vs. A third reason may be drawne from the *cold Aire* of these mountainous regions, which by an *Antiperistass* keepes in, and strengthens the *internall heat*, the cheife instrument in *naturall* and *vitall operations*. For who perceiues not his *vitall*, and by consequence his *intellectuall* parts, in *cold frosty weather* to be more strong and vigorous, then in *hot and soultry seasons*, wherein the *spirits* are more diffused and *weakned*. This disparity in the same region, at diuerse times, in regard of the disposition of the *aire*, may easily declare the disparity of diverse Regions, being in this sort diuersely affected. A fourth reason may be taken from the customary *hardnesse*, wherunto such people inure them selues from their *infancy*; which (as *Huanus* proues) begets a better temper of the *braine*, in regard of the *wit* and *vnder-*

standing; which we happen to find cleane otherwise with them, who haue accustomed themselues to *delicatness*. These reasons perhaps would seeme onely probable, and of no great moment, were they not strengthened with *forraigne* and *Domestick* observation. Haue not the *Helvetians* situate amongt the mountaines, giuen sufficient testimony; especially in the infancie of our *Reformation*? Haue not the *Suevians* & *Silesians* shewed themselues able enough, to wipe off the blot of a blockish disposition; yet hauing a situation wilde & mountainous? Had that great Doctor *Renclin* judged well of the nature of such people, he would not haue made it so great a wonder as he did, that wilde *Suevia* should produce such learned Men. *Forraigne* instances elsewhere wherin all histories abou'd, I forbearre to relate; desirous rather to be accompted deficient then tedious. Should I draw home to my natiue *Westerne Confines*, to which I owe my breath, I should perhaps by some be taxed of partiality or affectation. Should I mention our ancient *Brittaines*, inhabiting the Mountainous Country of *Wales*, or the greatest part of the *Scottish* Nation, injoying the like condition of life, and disposition of the Soyle; I might at once winne loue, & stirre vp envy. Neuerthelesse, as a man by nature borne carelesse of *Detraction*, yet most respectiue of *Friendship*, I had rather vengre my credit, then prejudice the truth: betwixt both which with me the choice is easie. Mine owne Country of *Devon*, which duty commands me to make the first Instance, I had rather set on the stage of Envy, then Dishonour. I am not of the opinion of the vain-glorious *Creekes*, who boasing too much of their owne perfections, esteemed all Nations els *Barbarians*. Yet to check Mr. *Bodin*'s bold conjecture, out of which he could finde but one *Anacharsis* in all *Scythia*; I will demonstrate that our mountainous Provinces of *Devon* and *Cornwall*, haue not deserued so ill, as to be so sharply censured for *Blockishnesse* or *Incivility*. Barren Countries haue bin known to nourish as good wits, as *Bodin*, *Aristippus* the *Philosopher*, *Callimachus* the *Poët*, *Eratosthenes* the *Mathematician*, haue not bin ashamed to call *Cyrene* in *Egypt*

gypt their native Country, a Mountainous and Rocky Region. Neither can it be stiled our reproach, but glory, to draw our off-spring from such an Aire which produceth wits as eminent as the Mountaines, approaching farre nearer to Heauen in Excellency, then the other in hight transcend the Valleyes. Wherein can any Province of Great Britaine challenge precedency before vs? Should any deny vs the reputation of *Arts* and *Learning*; the pious Ghosts of *Jewell*, *Raynold*, and *Hosker*, would rule vp in opposition; whom the World knowes so valiantly to haue displayed their Banners in defence of our *Church* and *Religion*. Should they exclude vs from the reputation of knowledge in *State* and *politick* affaires? who hath not acquainted himselfe with the name of *S^r William Petre*, our famous Benefactor, whose desert chose him chief Secretarie to thre Princes of famous memorie? Who hath not known or read of that prodige of wit and fortune *S^r Walter Rawleigh*, a man vnsfortunate in nothing els but the greatnes of his wit & advancement? whose eminent worth was such, both in *Domeſtique Policie*, *Forreigne Expeditions*, and *Discoveries*, *Arts* and *Literature*, both *Prattick* and *Contemplative*, which might seeme at once to conquere both Example and Imitation. For valour and chivalrous Designes by *Sea*, who reades not without admiration the *Acts* of *S^r Francis Drake*, who thought the circuit of this Earthly Globe too little for his generous and magnanimous Ambition? Of *S^r Richard Grenvill*, who vndertaking with so great a disadvantage, so strong an Enemy; yet with an vndaunted Spirit made his Honour legible in the wounds of the proud *Spaniard*: and at last triumphed more in his owne honourable Death, then the other in his base conquest? Of *S^r Humphrey Gilbert*, *S^r Richard Hawkins*, *Davies*, *Frobisher*, and *Capt. Parker*, with many others of worth, note, & estimation, whose names liue with the Ocean? In the Catalogue of able and worthy Land-Souldiers, whose eye would not at first glance on my *Lord Belfast*, who lately deceased to the great grieve of his Country, because in such a time which most requires his assistance? *Courage*, & *W^sdome*, which are often at odds, and seldom meet, in him shooke hands.

hands as friends, and challenged an equall share in his perfections. His wise managing of his affaires in Ireland, so well commends his owne *Loyalty*, and his Masters choice, that the whole Realme may truly be said for the most part to owe her present Peace to his Industrie. Should I speake of Generous *Magnificence* and Favour of *Learning*, shewed by Heroicall Spirits in the generall *Munificence* extended to our whole *Vniuersity*; what Age or Place can give a Parallel to renowned *Bodley*, whose name carries more perfwation then the tongue of the wilest Oratour? His magnificient *Bounty*, which shewed it selfe so extraordinarily transcendent; as well as creation of his Famous *Library*, which he (as another *Ptolomy*) so richly furnished, as other munificent *Largesses*, exhibited to our *English Athens*, was yet farther crowned by his wise choice, as proceeding from one, who being both a great *Scholler*, and a prudent *Statist*, knew as well how to direct as bestow his liberality. If *Founders* and *Benefactors* of private Colleges may find place in this Catalogue of Worthies, the sweet-hue and receptacle of our *Westernne* wits can produce in honour of our Country a famous *Stapledon Bishop of Excester*, and worthy Founder of *Exon Colledge*: whose large bounty was afterward seconded (next to *Edm. Stafford Bishop of Sarum*, a *Westernne Man*) by the pious charge and liberality of *Mr John Perrym*, *St John Acland*, & very lately by *Mr D^r Hakewill*, whose worthy Encomium, I (though unwillingly) leaue out, lest I should seeme rather to flatter then commend his Worth. But what needes he my poore mention? His learned works published to the World, & his Pious Monument bestowed on our House, speake in silence more then I can vtter out of the highest pitch of Invention. To all which I might adde *Mr Nicholas Wadham*, whose liberall hand having augmented the number of our Colleges with an absolute and compleat Foundation, hath left Muses enough to preserue his Name vnto eternity. Had I the like priviledge to mention the living as the dead, we should not finde wanting out of the ashes of these generous *Heroes* of our *Devonian* confines, many genuine and worthy Sonsnes standing vp in their Fathers places, to shew the world

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a succession aswell of wits as times. There would appeare at once vpon the stage our famous Dr. Sutcliffe, the worthy Dean of Excester, whose magnanimous indeavours, aswell in his learned conflicts with our pernicious Romanists, as in erecting a College to oppose our sworne enimis, the *lesuites*, will (no doubt) lengthen out the end of his declining age with Fame and Immortality. I could offer to your admiration the Worth and Workes of our renowned Rector, D^r *Prideaux*, His Majesties learned Professour of Diuinity in our Vniuersitie, in whom the Heroicall wits of *Iewell*, *Raynolds*, and *Hooker*, as united into one, seeme to triumph anew, and threaten a fatall blow to the Babylonish Hierarchie. Insomuch that he may justly challenge to himselfe that glory, which sometimes *Ovid* speaking of his own Country;

Mantua Virgilium laudet, Verona Catullum,

Romane gentis gloria dicar ego.

Mantua Virgil, Verona Catullus praise,

I will the glory of the Romans race.

Neither want the Lawes of our Land, out of this one source, sufficient propps to defend their Countries & the Kingdomes right. The admired sufficiency of *Justice Doddrige*, testified to the world by so large a report, and expressed in his incomparable skill in the Lawes (besides his indowments of Arts and other Learning, seconded by the deserued Fame of M^r *William Noy*) can hardly scape my pen, being so deeply dipped in the midst of my Native Countrey. I care not what envy I stirre vp in others, so my Mother *Excester Colledge*, which sometimes cherished in her bosome these two worthy Darlings, and since found h^r curtesie returned back with interest, indulgently permit me this liberty.

Besides these choice floures cropt from our *Hesperian* garde, no question but many more would be found out aliue or dead; whom fame, if not injurious, cannot suffer to sleepe without deserued memory. I haue bitherto touched such eminent wits and persons, of whom for their proleision sake the *Church* or *Common-wealh* haue greater reason to take espeiall notice. Many inferiour facultie^s are yet left where-

in our *Devon* hath displaied her abilities aswell as in the former, as in *Philosophers*, *Historians*, *Oratours*, and *Poets*, the blazoning of whom to the life, especially the last, I had rather leaue to my worthy friend *M. W. Browne*; who as he hath already honoured his countrie in his elegant and sweete *Pastoralls*, so questionles will easily bee intreated a little farther to grace it, by drawing out the line of his *Poeticke* Ancestors, beginning in *Iosephus Isecanus*, and ending in himselfe. *Bodin* perhaps might oppose against vs the eminency of his *Parisian* territory, as some with vs the glory of our *Metropolis* and *Vniuersities*, disdaining all comparison: But to this it is not hard to shafe an answeare, 1 That a *Metropolis* or *Vniuersity* is to be imagined as a common recepacle of the most selected wits deriued rather from other places then the temperament of their owne Aire: Insomuch as they may be said to owe their abilities, for the most part, to those to whom they owe their wealth. Neither can they challenge a greater interest in this glory, then our *Townsmen* heere in *Oxford* in the eminent guifts of our choicest *Schollers*; Besides, that often happens in our great *Metropolitan* cities by the promiscuous concuse of diuerse dispositions; which is reported of the *beasts* once a yearre comming together to drink of *Nilus*, of diuerse sorts; that by vnnaturall commixture, they yearely beget new monsters: *Africa aliiquid semper aportat noni.* 2 The ready meanes of *Advancement* to high and eminent dignities in *Metropolitan* cities, which are commonly the ordinary seats of *Princes*, sets many a braine a worke although *In vita Minerva*, to shew it selfe in publique: wherein he hath the advantage of estimation sooner then sufficiency: wheras many a towardly wit in places farre remote, neuer finds opportunity so propitious as to present him to popularity. I feare I shall be too tedious in this point, recalling to minde that I shall find few of my readers in this matter so affected as my selfe: Yet should I not haue spuane out this theame so long, but to stop their mouthes who being sooner taught to speake then understand, take advantage of the rude *language* and plaine *attire* of our countymen, admiring nothing more

then

then themselves or the magnificent splendour of their owne habitation: As though all the witt in the world were annexed to their owne *schools*, and no flowres of science could grow in another garden: But a rude *dialect* being more indebted to *Custome* then *Nature*, is a small argument of a *blockish* disposition: and a homely outside may shroud more wit then the Silke-wormes industrie. I haue sometimes heard a rude speach in a *Froze habite*, expresse better sense then at other times a *scarlet Robe*: And a plaine Yeoman with a mattocke in his hand speake more to the purpose, then some Counsellours at the barre: And what other prorogative can such men appropriate to themselves aboue vs, but toyes and formalities, the *Idols* of *Gulls* and *fooles*, and the laughter of solide vnderstandings? But now after all this bickering with *M^r Bodin* to grow to a reconcilement, ere we part, we will part stakes, and in the way of kindenesse giue him this one distinction, which I hope for quietnesse sake, he will accept. The Naturall disposition of men and their gifts of vnderstanding and mentall faculties, arise either from their *naturall Temper*, or their *Discipline* and *education*: For the former I haue small reason to giue (as I haue said) the excellencie to the inhabitants of *plaine* and *low Countries*, rather then to the mountaine people: But in *discipline* and *education* I must confess others commonly to be happier. 1. Because the *Fertility* and increase of the Earth inviting men to such an Habitation, it must needes happen that such Countries must be more populous, and by consequence settle to themselves a better forme of *governement*, then those which by reason of their barren soile are more neglected: 2 Because, most *Cities* and *Townes* where are found the cheifest meanes of *Institution* of youth, are founded in *plaine Countries* and vallies. This *Perfection* that such regions boast of, is owed rather to *Institution* then *Nature*: Hence appeares the reason of the last clause of our Theoreme, to wit, why they should be lesse tractable to *governement*: Because being (as it were) borne to too much *liberty*, they cannot so well inure themselves to *subiec-
tion*, as other who perhaps know no *Condition* but serui-

of the mountainous people of *Wales* and *Scotland*, I cannot speake so much as I intended : Both because I haue (I feare) tired already my readers patience, as also for that, being not so conversant in their Histories as mine owne, as an ill herald, I may chance to marshall all amisse. Who so list to reade the courage of our ancient *British* nation, he shall find enough aswell in the *Roman* Story, as our *English* *Chronicles*, to let them far enough aboue cont^{empt}, & place them an eye sore in the sight of envy. But to leaue *Antiquities* and come to these times, we may easily amongst many other deserving men single out some, whose eminence so obvious to the eye of common observation, is able to dash *detraction* out of countenance. Who hath not heard not many yeares since of *D^r Holland* the Kings Professour in our *Vniuersity*, and *Sir Roger Williams* a famous *Coronell* in the *French* and *Belgick* warres? the *Scholastical Learning* of the one, and the *martiall* *prowesse* of the other, was too well knowne to require a *Panegyrick*. Neither is *Wales* at this day below her selfe, but that she can triumph in two of the most *Honourable* and *Generous* *Peeres* of this Land, (to whose acceptance I owe these my poore labours) and the greatest *Administratour* of *Justice* in our Courts: the two former, borne aswell to *hæreditary* *verte* as *greatnesse*: the later advanced no higher then his owne *ability*, whom the world knowes beyond my expreſſion.

Scarce had I shut vp this tedious discourse, spent for the most part in defence of my *natiuē Country*, but surprized with a deepe melancholy, I entred into a serious consideration of what I had too rashly spoken: I called my meditations to a strict accompt, to examine what motiue should make me run so farre beyond my intended purpose, to meet the *Ambition* of my Country or mine owne affection. The remembrance of some grievances, seconded by mine inbred Nature, never taught to fawne on misprision, beganne to check my officious yenne, as guilty of too much *weaknes* or *Adulation*; when sudainly as in a vision there appeared vnto me my Mother *Oxford* shiel'd in by *Iris* and all his *Muses*, who with a discontented countenance and harsh language, seemed to chide me in this manner:

Fond

Fond Sonne, who caught thy vndeserued praise,
To crowne thy country with these thanklesse Baies?
What owest thou vnto that barren Earth
But harsh reproach, sad cares, and haplesse Birth?
What Legacie bequeath'd that soile to thee,
But fruitlesse Hopes, and helpless Poverty?
What thou hast spoken of thy Westerne stronds,
Will sooner plough vp mine, then cure thy wounds.
Had thy neglected Muse without a Name,
Spent halfe this iadustry to spinne my fame,
Isis had graced thee with Muses more
Then euer tript on thy *Devonian* shone.
Which of these Worthies whom thou crown'st with
Will ere thy wants relieve, or Fortunes raise? (praise
All the proud wooers of the Sisters Nine,
Like Pilgrims come to worship at my shrine:
And vauntest thou on *Devon's* part their Names
Who owe to me their worth, to her their shames?
The prime and choice of all thy gloriouse flowres
Cropt from my gardens and admired Bowres,
Ought to returne the tribute of their praise
Vnto my golden tongue and learned Layes:
Nor had thy Westerne Confines euer found
A Muse to sing of thy *Devonian* ground,
Had not I touched her ambitious tongue
First taught to chaunt amongst my learned throng.
How oft hast thou drawne out thy precious time
To tutour in my armes their youthly prime,
Who like respectles and vntutour'd swaines,
With losse and obloquie reward thy paines?
Such are thy Darlings whom thou wak'st to ride
In a triumphant carre by Honours side:
As if proud *Honor* which can Kings command,
As a poore seruant waited on thy hand.
Thus thou vnwise giu'st immortality
To those, whose base reproches follow thee.
Had thine Ambition waited on my springs,

The breath of Princes, and the pow'r of Kings
 Had seconded thy Hopes, which now accuse
 To my disgrace and grieve thy haplesse Muse.
 Thy wants inforce thee still with me to stay,
 When each *Pedant* or makes or findes his way.
 To play and stake it at that lawlesse Game,
 Selling my Honours for to buy their shame:
 Vnhappie purchase o'wd to Charitie,
 Bought by connivence, sold to Perjurie;
 By griping Brokers, since the fatall time
 That faire *Astrea* left thy thanklesse Clime.
 Thus thy admited *Devon's* charitie
 Sets strangers in her lappe and shuts out Thee.
 Hast thou bin honour'd by my sacred Breath,
 'Mongst rude *Arcadians* thus to beg a Death?
 What greater glory can thy ashes haue,
 Then in my flowrie groves to dig thy graue?
 Although the least among my learned sonnes,
 Thy fortunes told thee that I lou'd thee once,
 And so doe still: although my haplesse Baies
 Taught thy despaire to spinne out carelesse daies,
 And to compose thy discontented Head
 To slumber softlie on the Muses Bed.
 Be rul'd by me my poore, yet loued sonne; (done:
 Trust not their smiles whose wrongs haue thee vn-
 Thy faire Hopes grounded on thy place of birth,
 Will fly in *Atomes* or consume in Earth;
 Before within that Hemisphære of thine,
 Thy *Devon's* Sunne on thee shall ever shine.
 Then trust vnto my bounty, turne thy sight
 From thy darke Confines to my golden light.
 All thy endowments owed to my wombe,
 Returne them back, and there erect thy tombe.
 If no *Mecanæs* crowne thee with his Rayes,
 Teach thy content to sleepe our quiet dayes.
 Let Contemplation with transpiercing eyes,
 Mount thee a pitch beyond the starry skyes.

And

And there present thee that eternall glasse, /
Wherin the gressesse of this wondrous masse,
Shinkes to an *ame*; where my *Astrolobe*,
Shall shew the starres beyond thy painted Globe:
Where thou alost as from a mountaine sclope,
Shalt see the greatest men like *Antes* to creepe:
Thy daies shall minister thee choicest *Theames*,
Which night shall render in delicious dreames;
And thy feuere *Philosophy* the whiles,
In amorous kinde shall courte thee with her smiles.
Or if thy nature with constraint descends
Below her owne delight, to practick endes;
Rise with my morning *Phabus*, slight the *West*,
Till furrowed Age inuite thee to thy rest.
And then perchance, thy Earth which seldome gaue,
Thee Aire to breath, will lend thy Corps a graue.
Soone the last trumpet will be heard to sound,
And of thy load Eale the *Devonian* ground.
Meane time if any gentle swaine come by,
To view the marble where thy ashes ly,
He may vpon that stone in fewer yeares,
Engrave an *Epitaph* with fretting teares,
Then make mens frozen hearts with all his cries
Drink in a drop from his distilling eyes:
Yet will I promise thy neglected bones,
A firmer monument then speachles stones,
And when I pine with age, and wits with rust,
Seraphick Angells shall preserue thy dust,
And all good men acknowledge shall with me
Thou lou'st thy Country, when shee hateth thee.

This strange reproofe of an indulgent mother, I could not
entertaine without passions. In somuch as without feare or
wit, I adventured in this sort, to answere her, in her owne
language.

Ad Matrem Academiam.

Unkindest mother, haue my former yeares
Somuch deseru'd thy hate, or these my teares?

Thus to divorce me from my place of birth,
To be a stranger to my native Earth?
Wilt thou expose him on thy common stage,
To straine and strugge in an Iron age;
Whose low ambition never leard of thee
The curious Artes of thriving policy?
Thy golden tongue from which my yonger daies
Suckt the sweet musick of thy learned laies,
Was better taught thy office then my fate,
To make me thine, yet most vnfornatue.
Why was I fostred in thy learned schooles,
To study wit for the reward of fooles:
That while I sat to heare the Muses sing,
The Winter suddenly ore-took my Spring:
Haue I so plaied the truant with my howres,
Or with base riot stained thy sacred Bowres,
Or as a Viper did I euer struie,
Tognewā passage through thy wombē to thriue:
To pluck me thus from Devon's brest, to try
What thou canst doe when as thy dugges are dry?
When my short thread of life is almost spunne,
Thou biddst me rise vp with thy morning sunne;
And like a *Heliotrope* adore the *East*,
When my care-hastened Age arriues at *West*.
Could I encounter (as I once did hope,)
The God of learning in the *Horoscope*,
My *Phabm* would auspicious lookes incline,
On thy hard fate, and discontents to shine:
Now lodged in a hickles *house*, rejects
My former suites, and frownes with sad *aspects*.
Had I bin borne when that xternall hand
Wrapt the infant world in her first swadling band,
Before *Philosophy* was taught the way,
To rock the cradle in which Nature lay,
My *Learning* had bin *Husbandry*: My *Birth*
Had ow'd no toll but to the virgine *Earth*:
Nor had I courted for these thirty yeares,

Thy

Thy feuen proud minions with officious teares:
To lieue had bin my industrie: no tongue
Had taxt thy honours, guilty of my wrong.
Had I bin shepheard on our *Westerne* plaines,
I might haue sung amongst those happie swaines;
Some shepheardesse hearing my melody,
Might haue bin charmed kind as charity,
And taught me those sad minutes to repriue,
Which I haue lost in studying how to thriue.
Had I aduentur'd on the brittish forme,
And sworne my selfe a stranger to my home
Till time the *Harshest* reapt my yauth did owe,
And *Ages* winter had spent all her snow
Upon my haites; what worser could I haue,
Then loose thy frownes to find a wished g-au?
The Scythian hewne from *Caucasus* would aske
Before my slaughter, why a needles taske
Of *Travaile* I should vndertake, to see
Their Countries bounds and my sad mystery?
But hearing my harsh bondage vnder thee,
Would thine vnkindnesse hate and pitty me.
To see thy Childe fat f-er'd from thy wombe
The *Canniball* would make himselfe my tombe;
And till his owne were spent preserue my dust,
I his deere vrne which thou hast sleightly lost.
Canst thou neglected see his *Age* to freeze,
Whose youth thou dandist on indulgent knees?
The fowle aspersions on my *Devon* throwne,
Thou mightst in right acknowledge for thine owne:
On'y this difference: to men wanting worth
They *selly* preferments, and thou *sends* them forth.
Canst thou be brib'd to honour with a kisse
Thy guilded folly which deserues the hisse?
If thy forc'd wants and flattery conspire,
To sell thy Scarlet to a worthles Squire,
Or grace with minivers some proselite
Who nere knew artes, or reade the *Stagirite*;

Yet

Yet should thy hand be frugall to preserue
 That stock for want of which thy sonnes may starue.
 Haue I seru'd out three prentiships, yet find
 Thy trade inferiour to the humblest mind?
 And that outstrip by vathristes, which were sent
 Free with indentures ere their yeares were spent?
 Then cease ye sisters of the Theffian springs,
 Thalia burne thy bookees and breake thy strings,
 And mother make thy selfe a second Tombe
 For all thy offspring, and so shut thy wombe.
 Accuse not my iust anger, but the *cause*
 Nature may vrge, but fury scornes her lawes.
 If awn'd too long on Justice; Sith that failes,
 Storme Indignation and blow vp my sailes;
 Ingenious choller arm'd with Scorpions stings
 Which whippst on Pesants, and commandest Kings,
 And giu'st each milky soule a penne to write
 Though all the world be turned a *parasite*;
 Temper my braies, thy bitternesse infuse,
 Descend and dictate to my angry Muse.
 O pardon mother something checkes my spleene,
 And from thy face takes off my angry teene:
 Revolted Nature by the same degrees
 Goes and returns; begges pardon on her knees:
 Thou art a *mirrour* by reflexion taugt
 To saigne defects, yet guilty art of naught.
 Thy *stewards* which by thy indulgence thriue
 Were they as iust, as thou art free to giue,
 We all might share a portion of that store,
 Which now thy sonnes deserue, thy *slaves* devoure.
 Thy *will* is seldom measur'd by the *Law*,
 But *power*, whose greatnesse thy Edicts can awe,
 Slights thy decrees: O would I *Imperiall* *One*
 But once descend from his high Court aboue,
 To see thy innocent and maiden hands,
 By thine owne seruants basely shut in bands:
 These *Caterpillars* by his three-forkt *Rayes*,

Would

Would soone be scorch'd from off thy sacred *Bayer*;
And thou restor'd vnto that pristine hue,
Which ancient times admir'd ours never knew.

All this time as in a fit of phrensy I haue spoken I feare
know what my selfe : I feare me too much, to, or of, my
Country and *Vniversity*, and too little for the present purpose.
Now as one suddainly awaked out of sleep, no otherwise
then in a dreame I remember the occasion : We haue all a *senel*
Insaniumus, and as a learned man of this *Vniversity* seemes to
maintaine, no man hath euer had the happines to be exempted
from this imputation : And therefore I hope my Reader will
pardon me this once, if in such a generall concourse and com-
spiracy of mad men, I sometimes shew my selfe mad for com-
pany.

3 *Windy Regions produce men of wild and
instable dispositions; but quiet regions more
constant and courteous.*

The cause of this disparity is apparent; because a quiet
mind, and apt for contemplation, cannot be in such a man, as
is perpetually tossed to and fro. For no man can well
contemplate, except he haue his mind purged and free from
motion of the body; and it is noted by *Physiognomers* that
wiser men are *slower* in the motion of their body and mind,
whereas mad and franticke men are alwaies busied in body &
mind. Hence a reason may be giuen why *Mariners* and *seamen*
being continually tossed with the wind, are observed to
be more *barbarous, inhumane, and inconstant*. Another reason
of this inconstancie and change, may be drawne from the
change of the *Aire*, caused by diuersitie of winds; For wind
being an exhalation affecting the aire and deriuied from the
Earth, must needs be diverse in regard of the diverse regions,
from whence it bloweth. What cause soeuer be imagined,
it is most certaine that people in windy regions haue bin more
warlike, though perhaps lesse humane: As in *Thracia, France,*
Circassia, Lybia, Portugall, Persia, Noruegia, and Polonia:
But in places in the same tract where the wind hath a lesse

domination we shall find them more tractable, but lesse valiant, as *Asyria*, *Asia minor*, *Italy* for the most part, and *Egypt*. In like manner the people of *Gallia Narbonensis*, *Aquitany*, and *Provence* in *France*, are observed to be the most warlike, although situate in a more Southerne tract: Being daily infested, partly by the *Vulturnus*, partly by the *Corus*, which in these parts hath great power.

4. *Sea borderers are generally more witty and adorned with more knowledge, then Inlanders, though subject to greater vices.*

That *Artes*, *Civiliz*, and many *inuentiones* are owed to the *sea*, as the mother of encrease, seemes a matter out of question: For sith all nations haue not found out all *arts* and *inuentiones*, it must follow necessarily, that they haue bin propagated by *traffick*, and *commerce* with forraigne nations: Whence it comes to passe many times that *sea-borderers* by conference with *out-landish* people, haue gotten that knowledge and experience of things, for which others haue with great cost and danger adventured on long and tedious travailes: Which I take to be the reason why *Themistocles* would haue a *Cite* depending on the *sea*, and not as *Calius Rhodoginus* imagines, that he might transferre the power from the *nobility*, to the *ship-masters*. Thus we find *sciences* and *learning* to haue bin derived from the *Chaldeans* to the *Egyptians*, from the *Egyptians* to the *Phenicians*, from them to the *Gracians* and *Romans*: And in our daies euery man can speake how much the *industrie* of the *Venetians*, *Spaniardis*, *Hollanders*, *English*, and *Portugalls* haue effected in both *Indies*, in *trafficking* with them, deriving together with their *merchandise*, much of their owne *knowledge* and *religion*: But as the *landers* & *sea-bordering* people haue excelled the *Inland* nations in *skill* and *knowledge*, so also in *vices*: Which stands with reason, whether we ascribe it to their naturall *wit* or condition of life, or *education*. For the greatest *wits* are commonly matched with the greatest *vices*, as depending on such a temper of the *braine*: whose smalleſt change may beget madnesſe: according:

ding to that proverbe, *Nullum magnum ingenium sine mixtura insania*. Also Artes and Sciences turned to the worst use, become more dangerous, then naked simplicity; for there is nothing to be feared more then armed furie. This might be the cause why *Plato* in his booke *de Republica* warnes men to avoide the sea, as the mother of wickednesse. Which is seconded by *Strabo*, who derives the of-spring of Robberie, pilage, and murther, from the sea: By which argument, the old Athenians were enduced to draw the Inhabitants as much as they could from sea-trafficke to husbandry and tillage of the Earth: Whence came at first (as some imagine) that fable of *Neptune* striving with *Minerva* for victorie, against whom she prevailed, by shewing the judges a mandrakes apple as an especiall rarity of the land.

C H A P. XVI.

Of the dispositions of Inhabitants according to their Originall and Education.

IN the third place there may be a diversitie of Inhabitants in disposition, either in respect of their Of-spring, or their Education. In the former we are to consider the dispositions of nations so farre forth, as it depends from their first stocke and originall.

By the first stocke and originall of nations, we understand not heire either the first of spring from the loynes of *Adam*, or the second from *Noe*; because these two are common to all

all nations of the world, and therefore cannot vary the seuerall dispositions of people: But the more mediate or speciall stock whence they sprang, which is found to haue no small power in the nature and temper of posteritie. In this of-spring two things are chiefly remarkable; first, how people suffer an alteration in respect of their seuerall *Transplantations*: Secondly, in the *mixture* of colonies, both which we wil shew in these Theoremes.

I. Colonies transplanted from one region into another, farre remote, retaine a long time their first disposition, though by little and little they decline and suffer alteration.

All mutation requires a certaine distance of time: Sith no motion according to Aristotle is in an instant, neither is it a small time can alter the naturall *complexion* of men: For as much as the children for the most part derive their nature from their parents, and every mans constitution is commonly radically grounded, and not easily subject to exterrnall change: Thus wee see the Children of *Blackmores* being transplanted into *Europe* for diverse descents to continue black: Yet so as they by little and little declining from their former hue, will in time become white; as the rest of the *European* Inhabitants: For otherwise it must needs follow, that *Scythia* should at this day breed many *Blackmores*, and *Ethiopia* many white; because no question can be made but that all nations almost of the world since the beginning haue suffered mixture. We reade that the *Gothes*, being a warlike people of the *North*, long after their first invasion of *Spaine*, *France*, *Italy*, and other Territories of *Europe*, retained their owne disposition and naturall, altogether disagreeing with the nations, amongst whom they liued: gouerning (as is the manner of *Northerne Potentates*) rather by *Strength* then *Polisy*, better able to winne then establish an Empire. But in proesse of time it came to passe, that putting off their harsh temper they grew into one nation with the native Inhabitants, as in *France* and

and Italy, or at least as in Spaine, establishing a government to their owne, by little and little declined from their rudenesse to civility, turning their armes to Artes, their strength to straingemes, having of late yeares by witty policy established a greater empire, then euer their Ancestours could atcheive by multitudes of men, and strength of armes. And it is worth observation, that as these haue suffered a change of *Laws, customes, government*, which they owe more to the nature of the Climate then to Education; so in their very language. For the language of the Gothesheeretofore, differed little from the language of the ancient Germans, which (as most Northern languages) was very rough, consisting of many hard and harsh aspirations, with vnplesant collision of many consonants together: But at this day is changed into a very elegant tongue pleasant to the eare, consisting of many vowels, and the softest aspirations. Finally such haue bin the alterations of this people, that being heretofore far North, & branded with all the markes of Northern rudenesse, they are now esteemed in the Catalogue of Southerne Inhabitants: Not in regard, as much of place, as nature. The like may we obserue of the Turkes and Tartars, who spreading their empire from the North towards the South, a long time retained their rude barbarous nature, which they haue not at this day altogether cast off, yet somuch hath time and place gained vpon their temper, that they are much mollified and farre more tractable to humanity, addingit themselves euery day more and more to the study of artes and civility: insomuch that (as one obserues) had they not preserved their strict discipline in training vp their youth to armes, they had long since lost much of their large empire, and haue yelded to the Polonian and Muscovite. This change may we find not onely in mankind, but also in beastes and plantes, which being transported into other regions, though a long time retaining their natvie perfection, will notwithstanding in time by little and little degenerate: As I haue heard by relation of some of our Virginian colony in America: who find a great alteration in our Corne and Cattell, translated thither. This might also be obserued in the

Danes, Saxons, and Angles, comming into Britanny, who partly by the Climate partly by mixture with them, by little and little deposed their disposition, and became more civil. The like may be spoke of the Saxon colonies sent by Charles the great into Belgia, who since that time becoming more civil have proued lesse warlike, loosing asmuch by the one, as they obtained by the other. This point I will no further persecute, because I hold it sufficiently demonstrated out of that I have spoken of the variety of naturall dispositions according to the heauenly situation, and the soile. For sith a nations came at first from one originall, we must needs ascribe this mutation to the places which they inhabite.

2. *The mixture of Colonies begets in the same nation a greater disparitie and varietie of the Inhabitants amongst themselves.*

This pronostication is by naturall consequence deduced from the former: Because all Colonies transplanted retaining some-what of their former nature, the Mixture must produce varietie. First, because the number of people of any region by this is supposed to consist of more kinds of dispositions: 2ly, because the promiscuous mixture of these kindes being vnequally tempered, must according to their severall cōbinations produce people, as unlike one to the other, as to the former. Hence a reason may be giuen, why the Inhabitants of the extreme regions, either North or South are found to be amongst themselves aswell in temper, as in externall face & habite more like one to the other: whereas the middle partake of more variety. For the Cimbrians, Danes, and other Scythians, are for the most part of a whitish hue, with flaxen, and yellow haire; on the other side the Ethiopians for the most part are black-haired and curled. The French, Germans, and the English, admit of all varietie, hauing some white-haired, some black, some yellow, some tawny, some smooth and some curled-haires. This diversitie the Stoicks would ascribe to the phantacie, or image conceiuied in the mind of men. Whence they would giue a cause, why beasts commonly

bring

bring forth yong, more like one the other then men; because (say they) wanting a reasonable soule they are not stirred vp vs men with sundry cogitations, but onely with sente. So the Scythian and Northerne man being by nature more simple, & affecting those pleasures which are agreeable to nature, and lesse distractred by variety of thoughts, is found to beget children more like their parents then th ose of the middle climate. This cause we should admit probable enough, but for a reason vrged by Bodin and others, that in *Aethiopia*, where the people of all other is more *Acute*, and more violent in lust, they are most like one to the other. For even all are found to be small of stature, curly-hared, black-skinned, flat-nosed, smooth-skinned, great-lipp'd, white-toothed, black-eyed: Wherefore this infinite diversity in the middle region, we cannot well ascribe to any other reason, then the manifold intermixtion and combination of both the extremes. Whence it comes to passe, that by how much more we wander from the middle region, somuch the more like shall we find the people amongst themselves. In somuch as *Tacitus* spake of the *Germans*, that amongst themselves they were very like in respect of other nations. This mixture in the middle region out of the extremes, may easily be shewed out of diverse Colonies, which from the extremes, haue binne translated into the middle region, as the better place of habitation. For hither came the great and extraordinary armies of the *Scythians*, *Goths*, *Turkes*, and *Tartars*; None besides the *Vandalls* passed into *Afrique*, from whence they were in short time expell'd. The *Arabians* and *Punicaans* called by the ancient *Saracens*, leading their Colonies into *Europe* & *Asia*, settled themselves in the middle region; None came into *Scythia*: for when they had invaded *Spaine*, *Italy*, and *France*, they were in *France* altogether broken, and cut off: After which, *Spaine* and *Italy* found a meares to free themselves from their bondage. Likewise the Colonyes of the *Celtes* and *Romans*, endeavoured alwaies to settle themselves in the middle Region, and never ventured as far as *Scythia* Northward, or Southward as farre as *Aethiopia*: Whence the middle charged

20. GEOGRAPHIE. The second Booke.

with intermixture of both extremes begat a great diversitie. For we find by experience, that out of the mixture of diverse kinds, diverse Formes and Natures are engendred: As of the *Mule*, *Leopard*, *Crocata*, *Lycisca*, and *Camelopardus*; which being mixt Creatures are vnlike their Sires: So may we iudge of the various mixture of diuerse kinds of men. A *Mastiff* or *Lycisca*, little differs from a *Wolfe*, because he was con-
cieued of a *Wolfe* and a *Dogge*; So that a *Wolfe* is (as *Varro* no-
teth) nothing els then a *wilde Dogge*. But on the other side, a
Mule from an *Asse* and a *Horse*, As a *Camelopardus* from a
Panther and a *Camel*, differ very much; so that if people very
neere in Nature be linckt together, they produce an of-spring
very like themselues: But if two very vnlike in nature, as an
Aethiopian and a *Scyrian* should match together, they must
needs bring forth a birth very vnlike to themselues: like
a *Personated man* brought vpon the stage by *Ptolomeus Philo-
lephus*, who (as *Athenens* writes) was of two colours, on
one side white, on the other black.

2. The second point whereby the dispositi-
on of people is varied, is *Education*. Edu-
cation is the exercise of many people in re-
ligious, or morall discipline.

Amongst all externall causes of the change of dispositions, there is none greater then *Education*. For as a good nature is oftentimes corrupted with evill conuersation, so an ill dispo-
sition with good institution hath in some sort bin corrected. The cheife objects of discipline are *Religion* and *Morality*: Whereof we give the cheifest prerogatiue to *religion*, as that which more immediatly bindeth the *consciences* of men, even
against nature. In the second place *Civility*; whose end is
worldly happiness. How farre each of these pravaile, shall be
shewed in these Theoremes.

1. Education hath great force in the alteration
of naturall dispositions: yet so as by accident
remitted

remitteſt, they ſooner returne to their former temper.

The force of *inſtitution* hath bin ſo great, that by ſome, hath bin thought to æqual, if not ſurmount *Nature*; whence they haue tearmed it a *ſecond nature*: For as we ſee all ſortes of *Plantes* and *Herbs* by good husbandrie, to grow better, but leſt to themſelues to grow wilde and barren; So ſhall we find it, if not much more, in *marking*; which though neuer ſo *Savage* & *barbarous*, haue by discipline bin corrected and reformed, and though neuer ſo *Polite* and *civill*, neglecting discipline, haue degenerated, and growne barbarous. For if the externall lineaments of the *body* may be by art (as it were) wrought into another mould, much more may we ascribe this to the habits and operations of the *mind*, being of a more agill nature, and apter to receive impression. The ancients amongst the *French* (as Bodin testifies) deemed a long viſage the moſt handsome: Whence the Midwifes endeoured to frame moſt faces to this fashion, as may be ſene in moſt ancient ſtatues & images. In *India* (as we alſo reade) a great noſe and a broad face was moſt admired: which caused their midwifes to effect it as neare as they could in their tender infants. In like manner it hath bin the endeavoure and ambition of moſt teachers, and informers of youth, to frame the wits of their nouices to ſuch disciplines and perfections, as in the ſame country found moſt honor & best acceptance. Hence it came to paſſe that cuſtome prevailing beyond *nature*, many nations ſituate in a ruder climate wanting that benefit of the *Heauens* which others plentifully enioye, haue ſurpaſſed them in *Artes*, *Sciences*, and many other *Endowments* of the minde. In ſo triviall a matter we will not troue farre for example. It is recorded by the ancients, aswell of the *Germans*, as of our owne nation, that they liued almoſt in the condition of wilde beaſts in Woods & Desarts, feeding like ſwine on *herbs* and rootes, without law or discipline: In ſomuch as their *Bardes* or leatned men (as they deem'd them) wanting the uſe of letters, challenged their cheiſteſt perfection in the compoſure

of certaine rimes of triviall subjects to please the people. Their houses were *caues*, their *pallaces* *brakes* and *thicketts*, their *tables* *rockes* (as one saith of them) *Antralares*, *dumeta thiros*, *cananula rupes*. They were (as *Iustine* speakes of the infancy of the world) rather carefull to keepe their owne, then ambitious to conquer others; and more studious to preserue life, then seeke honour. Their onely law was nature, or some few customes preserued by tradition, not writing: Little differing from the present *Americans*, not yet reduced to civility. But time and discipline prevailing against *barbarisme*, they are (God be praised) reduced to such a height of civility, that they may (as it were) reade other mens warres in their owne perfections, and measure other mens losse by their owne gaines. In somuch as they seeme to haue robbed the *Asiatickes* of *humanitie*, the *Romans* of *militarie Discipline*, the *Hebreues* of *Religion*, the *Gracians* of *Philosopbie*, the *Egyptians* of *Geometrie*, the *Phoenicians* of *Arithmetick*, the *Chaldaens* of *Astrologie*, and almost all the world of curious *Workmanship*. This their excellency hath bin so fortunate, as to set them in the envy of other nations, who notwithstanding haue bin faine to borrow of their store. The *Italians* are censured by *Machiavell* the *Florentine* for sending for *Germans* to measure their land, challenging to themselves the prorogation of *warre* about other nations. Likewise *Pope Leo* dispatched his Embassador into *Germany* for *Mathematicians*, to rectifie the *calender*, as sometimes *Cesar* into *Egypt*. This force of discipline how great soever being for a time neglected, nature is notwithstanding found to returne to her owne corruption. A prime example of it we haue in the *Romans* and *Italians*, heeretofore for *Artes* and *Military discipline* carrying away the palme from the whole world: But now degenerated so much, as it may seeme the image of basenesse; submitting their neckes to the pride of an insulting *Prelate*, farre more abject then the losse of their libertie vnder *Cesar*, or the *Gothes* *surpuration* of *Alaricus*. The like effect of this neglect of discipline may we find in the *Hebreues*, *Chaldaens*, *Phoenicians*, *Egyptians*, *Gracians*, and *Indians*,

who

who were sometimes admired for learning and Eloquence, and set in the highest top of perfection. Wherefore Aristotle had good reason in his first booke de Cœlo to affirmie, that *Artes and Sciences with all nations had bin subject to ebbes & flowes, sometimes flourishing in great perfection, and sometimes languishing and contemned.* And to this and no other cause, can we ascribe the present *Ignorance and Barbarisme* of the *Americans*? Their descent being from Noah and his posterity, they could not at first but haue some forme of *discipline*, which afterwards being by long processe of time or incertainty of *tradition* neglected & obliteiated, they fell back into such waies as their owne depraved nature dictated, or the devill malitiously suggested.

2. *If Discipline nations become more wile & politick in the preservations of states, yet lesse stout & courageous.*

As Discipline hath bin the cheife cause of the establishment of all states, so bath it on the other side bin occasion to *soften* and weaken the courage of many nations: For it hath binne many times seene, that such people who haue bin commended for *wit*, haue yeelded to such who are of a ruder disposition: as at this day the *Greekes* and *Macedons* to the *Turkes*, the ancient *Gaules* to the *French*, the *Egyptians* to the *Persians*, the *Chaldaans* to the *Saracens*. Hence some giue a reason why the *French* did invade and runne over *Italy* without contrle vnder *Charles the 5*; because the *Italian* Princes at that time were giuen to *study and learning*; and it is observed that the ancient *courage* of the *Turke* is much abated, since the time that they grew more *civill* and more strictly imbraced discipline. And this some think to haue giuen occasion to *Alexander the great*, to conquer the *Persian Monarchie*, the *Persians* having bin before reduced to *civility*, and lost their *hardnesse*. And we daily see by experience, that no men are more desperate and aduenturous, then those which are *rude & barbarous*, wanting all *good manners & education*. *None more fearfull and many times more cowardlike* then

such as are most wise and politik: an example of the former we haue in *Ajax*, of the other in *Ulysses*, wherevpon the wi-
sest leaders and commanders haue not bin esteemed the most
valiant. A certaine English gentleman writing military ob-
seruations affirms the *French nobility* to be more valorous
& couragious then the *English*: Because of the loosenesse of
their discipline and the strictnes of ours. But I will neither
grant him the one or the other, neither can I averre their
courage to be greater, or our discipline stricter. If their valour be
more, it must needs follow their wit is lesse out of this ground.
But howsoeuer it be, I am sure that *Cesar* and *Tacitus* giue
the cause of the great stature and courage of the *Germans* to
be their loosenesse and liberty, which howbeit it be not the
sole cause, it must needs be a great helpe. For we plainly
 finde by experience, that those countries which be most moun-
tainous where is lesse discipline, are found to produce men for
the most part, most warlike: Such as the *Satzers* in *Germa-
ny* and *Biscaynes* and *Arragonians* in *Spaine*. Whence (as
some obserue) such countries as are partly *Mountanous*,
partly *plaine* are seldoome at quiet, the one part willingly
submitting themselves to government, the other affecting
warre and rebellion. Which hath bin the cause of the trou-
bles of *Naples*, and in *England* before *Henry the eighth's* time,
betwixt the *Welsh* and *English*: Why discipline should in this
sort mollifie and weaken the courage of men, many causes
may be giuen. The first, and greatest is *Religion*, then the
which, there is no greater curse to the courage; not merely
of it selfe, but by accident; Because *Death* being the greatest
hazard of a soldier, religion giues a more evident apprehension
& sense of the *immortality* of the soule of man, and sets be-
fore the eye of his ynderstanding, as it were, the images of
Hell-paines and *Celestiall joyes*, weighing in an æquall scale
the danger of the one, and the lesse of the other. Whereas
ignorant people wanting all sense of *religion* lightly esteeme
of either, holding a temporall death the greatest danger.
Whence grew the vsuall Proverbe amongst profane *Ruffians*: that
conscience makes cowards. But this (as I said) is mere-
ly

ly accidentall: Forasmuch as nothing spurres on a true resolution more then a good *conscience*, and a true touch of religion; witnessse the holy *Martyrs* of the *Church* of all ages, whose valour and constancie hath outgone all heathen presidents. But because soldiers for the most part, being a most dissolute kinde of people, hauing either a *false religion* which can suggest no settled resolution, or an ill conscience grounded vpon no assurance, *Religion* must needs beget in them a more *fearefull disposition*. Another cause may be the severity of discipline, which especially in the training vp of youth, is mixt with a kind of slavery: without which our yonger yeares are very vtractable to tast the bitter roots of *knowledge*. This feare(as it were) stamped in our affections cannot but leaue behind it a continuall impression, which cannot sudainly be razed out. Such as we find in vs of our *masters* & *teachers*, whose *freindship* we rather imbrace, then *familiarity*. A third reason, why discipline would weaken and mollifie a nation, may be the delight which men reape in *Contemplative* studies, and *morall* or *politick* duties, whence followes a neglect of the other. For people of *knowledge* must needs finde a greater felicity in giftes of the mind, which is vsually seconded with a contempt of externall and military affaires. The last cause may be the want of vs and practise of military affaires in most common-wealthe; for many states well establisched continue a long time without warres, neither molesting their neighbours, nor dissenting amongst themselues; except very seldome, and that by a small army, without troubling the whole state: whence the generall practise being lesse knowne, becomes more fearefull. Notwithstanding, all this it were brutish to imagine discipline any way *unnecessary*, or *hurtfull*, either to a *captaine* or *statesman*: Forasmuch as it more strengthens the *wit* then abates the *courage* of a nation. Neither is it properly said to break and weaken, but rather to temper and regulate our spirits. For it is not *valour*, but rather *rashnes* or *fiercenes*, which is not managed with *policy* and *discretion*. And although it hath sometimes bin attended with notable exploites, as that of *Alexander* the

the great, of the Gothes, the ancient Gaules and many other. Yet shall we obliue such conquests, to be of small continuance: For what they atcheived by strength, they lost for want of *policy*. So that it is well said by one: that *moderation* is the mother of *continuance*, to States and Kingdomes. Thus haue we runne ouer (by God's assistance) the cheife *causes* of diuersitie of *dispositions* of Nations: Wherein if any man will enforme himselfe (as he shalld) he must compare one circumstance with another, and make his iudgement not from a man but a nation; and not censure any nation out of one observation: For *practise* in *Art* cannot alwaies come home to *speculation*. So *experience* in this kinde will oftentimes crosse the most generall *rules* we can imagine. Tis enough to iudge as we find, and walke where the way is open; If any man will desire more enriositie, he may spend more labour to lesse purpose. Let euery man by beholding the *nationall vices* of other men, praise Almighty God for his owne happiness: and by seeing their *virtues*, learne to correct his owne *vices*. So shalld our travaile in this *Terrestriall Globe* be our direct way to *Heaven*: And that eternall guide shalld conduct vs which can never erre: To whom be ascribed all *Glory*, *Praise*, and *Power*, for evermore.

Deo triuni Laus in eternum.

FINIS.

